TRAFFIC QUARTERLY

AN INDEPENDENT JOURNAL FOR BETTER TRAFFIC

OCTOBER 1947

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THE ENO FOUNDATION FOR HIGHWAY TRAFFIC CONTROL
SAUGATUCK, CONNECTICUT

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Publication of this magazine is provided by income from an endowment by the late William P. Eno.

VOLUME I, NUMBER 4 OCTOBER, 1947

PRINTED BY COLUMBIA UNIVERSITY PRESS, NEW YORK, N. Y.

Habit

Carriages without horses shall go
And accidents fill the world with woe.

MARTHA (MOTHER) SHIPTON
1488–1561

IT SEEMS a simple matter of no great physical effort to raise your foot slightly from the accelerator, keeping to the right of the white line on a curve. Even a moron should be able to grasp the significance of that simple good habit.

In cutting the curve, the driver appears to appreciate some application of the laws of science but doesn't seem to understand that there isn't room for two on the same side of the road.

It would be an interesting study to trace the origin of the slothful driver who drives with one hand and hangs on the roof with the other, or the one with half a dead arm hanging from the door window of his car, or the hog (for lack of better description) who hugs the thin white line come death or destruction. And what of the other hog who lolls along at a snail pace mile after mile leading a caravan that cannot pass, ignorant or oblivious of his complete usurpation of the highway, giving nothing and taking all.

These driver faults come under the heading of Driver Habits. They are some of the bad ones.

They are unfair and exasperating to drivers of good habits who make an effort to share the road and extend an element of reasonable courtesy to fellow drivers. Generally it is difficult to be continually courteous to one who doesn't understand courtesy.

In driving it is difficult to be courteous without being a good driver and you can't very well be a good driver without being courteous.

Americans are good sports. They like fair play, they are concerned in keeping sports clean and fair. They like it strenuous but to many this is a form of expertness or efficiency, a knowledge of the game with an outward exhibition of a determination to win.

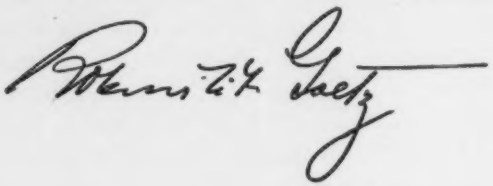
We are the first to express our dissatisfaction at a questionable

decision. We like to expose our support and always our sympathy for what we consider the underdog.

There are those who throw bottles at the umpire, but to paraphrase, how painful it must be to them to be the exception.

These commendable characteristics of Americans in sport are not in evidence on the highway and certainly there cannot be an altercation each time one is ignored.

This is not to condemn the driving public, but there's something queer and undefined about the "old bus," the family car, the high powered spitfire, or the boxcar type of truck that definitely affects some drivers' attitudes, making them morons, slothful or smart alec, unmindful of their stupidity or deliberately dangerous where under other circumstances or in other places they might be good company.



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Copyright 1947, by the Eno Foundation for Highway Traffic Control, Inc.

Published quarterly by the Eno Foundation at Saugatuck, Conn., issue for October, 1947.
Printed in U. S. A.

Police Training for Traffic Control

JOHN EDGAR HOOVER

John Edgar Hoover entered the Department of Justice in 1917. In 1919 he was appointed Special Assistant to the Attorney General. From 1921 until 1924 he served as Assistant Director of the Bureau of Investigation, and in May, 1924, he was named Director. In 1946, he was awarded the Medal of Merit by the President of the United States.

Mr. Hoover has been admitted to the practice of law before the United States District Court for the District of Columbia, the United States Court of Claims, and the United States Supreme Court. He is a member of the Executive Council of the Federal Bar Association.

Mr. Hoover is a life member of the International Association of Chiefs of Police; the International Association for Identification, and the Chief Constables' Association of Canada.

A PROFESSION has been defined as a calling in which one professes to have acquired some special knowledge to be used in instructing, guiding, or advising others or in serving them in some art.

Law enforcement has reached the status of a profession. Special knowledge has been acquired; it is used to instruct not only those entering careers of law enforcement, but also those who would live within the law. The public is guided and served through the operation of the law enforcement agency as an essential administrative arm of the government.

As in the professions of theology, law and medicine, constant training of the members of the law enforcement profession is necessary to maintain its character and efficiency. Advances made by business and industry must be matched step for step by law enforcement.

The invention of the automobile furnishes the best example of the effect an industrial invention can have on the duties and responsibilities of police agencies. As a comparatively recent product of inventive genius, the motor vehicle has become in a short period of time, one of man's most useful machines. It has revolutionized American living, and the concept of law enforcement as well.

EVOLUTION IN POLICE TRAINING

For many years the public tolerated police officers who were political appointees, with no particular qualifications for the job they had to do. Their training in defensive tactics was limited to the use of a night-stick in a heavy hand, where strength to subdue an adversary was the most important attribute. The average early-day police officer had little training, not much education and even less desire to improve his ability as a public servant.

In fact, he was not a public servant, but a political party functionary to whom the party owed a political debt. The job was one way to satisfy the party obligation. Although there were some absolutely fearless officers, who did outstanding work, we cannot now point with pride to the great majority of early law enforcement agencies.

As times changed, it no longer was popular to have a police department noted for its inefficiency. Farsighted leaders recognized that as society grew more complex, the status of law enforcement would be forced to improve or chaos would reign in the land. First as a theoretical proposition, then as a reality, training programs were instituted in progressive departments on an experimental scale.

The Usual Opposition

Opposition, as was to be expected, was immediately incurred from those who resisted change in any form. Officers with seniority in service feared that younger men with more adequate training would cause them to lose rank and require them to expend additional effort to hold their jobs.

In order to provide training programs it was necessary to have capable instructors. If the job of policeman was to be raised to the status of a profession it was essential to reach all members of police departments with modern instruction. It is also understandable that law enforcement a number of years ago had few competent teachers.

The FBI National Academy was inaugurated in 1935 for the purpose of training police executives and instructors. In the Academy, selected members of local law enforcement organizations

Model City used at the FBI National Academy, Washington, D. C., during discussions of Raid, Arrest, Traffic and Related Problems.

throughout the country were given intensive courses which would enable them to transmit their instruction to the members of their own organizations.

FBI Training for Nation's Police

In this fashion the latest methods and procedures in scientific crime detection were passed on to the interested local agencies. In response to requests training courses for officers in local departments were also held in various cities for police officers in the particular locality, and instruction was given by Special Agents of the FBI.

As the program of police training got under way, it became more popular. Its advertising was done by the favorable reports made by one officer to another, until the majority desired to get for themselves the training which was being made available. The courses of study were of a practical nature, taught in a clear, concise manner, with no attempt to furnish theoretical education but to provide work-a-day knowledge to assist the officer in handling the cases which he had to investigate on his beat.

It was not practical to teach chemistry to a policeman, but it was exceedingly pertinent for him to know what a chemist could do for him in the examination of a piece of evidence. It was not necessary for him to know geology, metallurgy, physics or electronics, but he was anxious to know how to obtain items of evidence from the scene of a crime, and what types of examinations could be conducted for him in the scientific laboratory. The policeman was equipping himself to fulfill his obligations as an officer of the law, to meet the modern criminal on an equal footing, and to prove his case in court. He was approaching the professional status.

Results

Between 1935 and 1944 the FBI furnished instructors for 1,513 local, county and state police schools. By way of contrast, in 1946 alone, the FBI conducted training in 1,785 schools attended by a total of 89,250 law enforcement officers. Nearly every police department of substantial size in the United States now has some form of

training school for recruits and an in-service training program for experienced employees.

Standards for employment with law enforcement agencies have been elevated in many localities, and coupled with intensive training, the average officer is reaping a higher respect for his ability and character. Law enforcement is in a vastly better position today than ever before to handle its multifarious problems. The public receives the benefits.

ENFORCEMENT IS PARAMOUNT

Traffic control, because it consists principally of law enforcement and the protection of life and property, is one of the functions of police agencies. Few would argue that it should be otherwise.

One of the best methods of protecting the public from the reckless and careless acts of some motorists is to enforce the laws fairly and without favoritism. In the criminal field it has been found that among the best deterrents to criminal acts are immediate and thorough investigation, swift apprehension of the accused, certain prosecution, and prompt sentence of those found guilty.

The same is true in traffic law enforcement. Surveys have shown that enforcement is a most effective approach to the traffic problem. Of the three E's—Engineering, Education and Enforcement—enforcement is the one which may be placed into immediate operation and the results will be almost instantaneous.

Long-Range Programs Needed, Too

Engineering and Education are long-range programs both of which require large expenditures and long periods of time in their accomplishment. While all three are necessary to a balanced and coordinated program, we must rely generally upon enforcement to meet immediate problems.

Surveys have shown that in some large cities of this country, 85 per cent to 90 per cent of all accidents were directly caused by violations of traffic laws. National estimates indicate that traffic *violations* are committed in two-thirds of all fatal accidents. These facts show

how prominently violations of the law figure in accidents. It is recognized that the majority of drivers perhaps do not become involved in many accidents, although it is by no means certain that the majority of motor vehicle operators obey all traffic laws.

Police Officer Is Deterrent

It is not possible to constantly check on every driver; consequently it is necessary to have motorists voluntarily obey the laws or to enforce the statutes to gain compliance. Those who drive sanely seldom endanger the lives or property of others, while the reckless operator of an automobile does not heed the statutes which have been passed for the protection of all who use the highways. The sight of a police officer is one of the few deterrents upon the careless driver.

With the return to pre-war peaks of automobile production, and with the increased use of many cars already on the highways, the problem of traffic accidents has become most important. Five thousand more persons died in 1946 from traffic accidents than were killed in 1945. Highway congestion in many places is greater than it was in 1941. A shortage of adequate places to park vehicles in metropolitan areas, and unsatisfactory street conditions contribute to the problem. As a result the public is becoming traffic conscious, and citizens notice inefficiencies in the handling of traffic.

SOUND PUBLIC RELATIONS

One resident stands in the door of his home and observes a car driven at a high and reckless rate of speed down the street in front of his property. His first reaction may be "Why don't the police arrest that reckless driver?" Later he sees a second motorist who is obviously under the influence of intoxicants. He wonders whether he will ever meet a drunk driver under adverse conditions and be the victim of an accident.

In a few days our citizen gets a summons to appear in traffic court for parking his car overtime in a restricted zone. He objects to paying a fine and suggests to the police officers that they arrest drunken and

reckless drivers rather than the "innocent" citizen who tarries 15 minutes too long in a department store while the clerk wraps up the packages he has purchased.

In all of the foregoing instances the police department is given an unfavorable rating by the citizen. If these occurrences are repeated often to enough citizens, the good will of the public is destroyed. It thus behooves the police department to cultivate voluntary compliance with traffic laws by the public to lessen the number of violations and to obtain cooperative effort in traffic safety.

What the Public Resents

The police department itself can do much from an administrative standpoint to reduce complaints against its activities and to provide the public with better service.

When early traffic laws were adopted police were inclined to use the same approach to the traffic violator as the criminal was given. Today, the average citizen considers himself respectable and law abiding, even though he does occasionally violate a traffic law, and he keenly and justifiably resents the verbal abuse or "bawling out" that some officers are in the habit of giving traffic law violators.

The driver who violates traffic laws is not a criminal in the usual sense of the word, and he vigorously resents any discourteous remarks by a police officer. Progressive police officials and many officers recognized long ago the necessity for eliminating any habits, methods, attitudes or language of police officers that bred popular resentment. They found that motorists objected more to the manner in which an officer issued a citation for a violation than they did to the citation itself. Complaints against officers showed that it was not so much what the officer said which offended the motorist as it was how he said it.

Courtesy Is Necessary

This presented clearly a police training problem in connection with the enforcement of traffic regulations. Today there are fewer and fewer officers who fail to recognize the importance of courtesy in contacts with traffic violators. When an officer is discourteous in his

approach to a violator it is a reflection upon his ability, it shows that he does not understand his responsibilities, and it indicates that his training has been neglected. Since the good will and respect of the public are such vital factors in traffic law enforcement, the importance of public relations training cannot be over-emphasized.

Many motorists who violate traffic laws are responsible, well-educated citizens, and there are many opportunities for the trained officer to acquaint them with their responsibilities as members of the motoring public, and in so doing acquire their support instead of contempt. People who are "sold" on traffic safety in this manner frequently prove to be loyal supporters of the police and may often exert considerable personal effort to promote and encourage others to drive safely. Seldom, if ever, can the reasonableness of traffic safety be disputed.

DANGER IN OVER-SPECIALIZATION

In analyzing the importance of training to traffic safety, it is essential that we recognize the necessity for every police executive to have a broad understanding of the techniques and methods of studying and approaching the problem. He should know what part traffic plays in the total police problem in his community, and how much time, equipment and training must be devoted to it to insure a reasonable degree of safety and convenience for the public. This understanding will require a constant study of the facts, and the application of the measures indicated by that analysis.

A concerted effort has been made in many cities, counties and states to solve the numerous difficulties which arise from the increasing use of the automobile. In some places there has been a tendency to over-specialize in an attempt to find a solution. This specialization has, in not a few instances, resulted in jealousies within police departments and an attendant lack of efficiency in the enforcement of traffic regulations and service to the public.

Every Police Officer Should Know Traffic

It is essential in the proper utilization of personnel of a law enforcement department to have each officer trained to handle the maxi-

mum number of violations of law. Such procedure gains the full services of the individual employee with the least amount of lost motion. It does not seem efficient to the average citizen at the scene of an accident to observe a police patrolman or two standing idly by while those involved await the arrival of specialists from the traffic division of the department to handle a fairly simple situation.

Every police officer should know how to investigate an accident, determine its causes and submit a good report on his findings. This is something within the ability of every officer, and it should be a function of the training program of every department to see that each officer is qualified and able to perform this task well.

While the study of traffic flow and accident analysis does require specialization, the vast majority of traffic problems occurring on the streets could be handled on the spot by the beat patrolman, if he has been afforded proper instruction. The evidence available at the scene of a traffic accident is certainly no more obscure than that to be found at the scene of a burglary which the patrolman is required to investigate.

He is just as competent to issue a "parking ticket" as an officer from the traffic division. Training has raised the ability of the average officer to the point where he can satisfactorily handle most of the incidents occurring in his territory. The added advantage of utilizing regular patrolmen to enforce traffic laws is the increased coverage of traffic that is obtained.

A More Frequent Check

For example, the simple regulation of restricted parking areas is a traffic law frequently encountered by the motorist in cities. According to a master plan, certain sections have been posted with signs such as "No Parking." The motorist will soon learn whether such regulations are enforced in his city. He will find out whether the traffic rules are enforced by officers from the traffic division who are few in number and are thus unable to visit all parts of the city frequently, or whether the officer on the beat, who frequently passes by, is charged with this responsibility. If the motorist is morally certain his parking violation will be noticed by an officer, and that a

summons will be issued, he will have a tendency to act in accordance with the regulations. When parking laws are violated with abandon, there is a more general disregard for all traffic regulations.

The average police officer who is to handle traffic duties along with other police obligations, should have an appreciation of the whole field of traffic safety. He must have an appreciation, not only for enforcement but also for engineering and education. It, however, is not necessary that he have a complete knowledge of the latter subjects. He must know something of engineering and education so that he will recognize in an accident investigation, for example, those conditions which were caused by poor engineering or a lack of proper driver education.

Training for Modern Enforcement

Many physical conditions on streets and highways cause or contribute to the cause of accidents. An officer should be able to recognize such conditions and should understand that it is his responsibility to bring them to the attention of his superiors so that the responsible agency is notified.

Similarly, the officer through his interrogation of drivers should determine what personal factors or defects might have contributed to the accident. A knowledge of these factors is of value in safety education and driver license administration. He should recognize and fully understand his duties as an enforcement officer to determine if any violations of law have been committed, and if so, to obtain evidence whenever possible to prove those violations to the satisfaction of a court. Training can equip police with the proper appreciation and skills for performing these duties.

Many small cities do not have the services of a traffic engineer, and occasionally there is little interest among local teachers and civic leaders to promote traffic safety education. The police, therefore, often find that they must do all of the engineering and educational work that is done. This is a condition which cannot be immediately overcome because some cities are not financially able to employ specialists for this purpose. Actually the police are in a very favorable position to conduct many safety educational activities.

Many officers have through study and training learned how to solve local traffic hazards which might normally be cared for by an engineer.

What Efficient Officers Should Know

Without proper collection, analysis and use of accident reports, enforcement effort may be misdirected and valuable time wasted; hazardous locations may not be identified, and unwise regulations might be adopted. It is not necessary that every officer know how to analyze accident reports and prepare collision and condition diagrams, but unless each officer has a knowledge of the many ways in which reports are used to solve traffic problems he might doubt the necessity for reports and will probably give little attention to the preparation of his own reports. A full appreciation of accident analysis can be developed only in a good training program where the subject can receive careful consideration.

Each officer should also have a thorough knowledge of first aid methods; he must be familiar with local laws and local physical conditions; he must understand the principles of efficient patrol, and know how to create respect for traffic laws and the safety of others. Although the task of directing traffic at intersections appears to be relatively easy, it requires considerable understanding to move pedestrian and vehicular traffic without conflict.

Every Citizen Is Benefited

It is not sufficient to train only the officers on the beat. It is even more essential that supervisory officers have a thorough and detailed understanding of the traffic problem and methods used to alleviate the troublesome situations. Those who guide the activities of men in a law enforcement agency must keep abreast of modern developments. They must pass on to their subordinates a desire to do a good job, a feeling that "getting by" is not good enough and that more is expected of them as public servants.

Enforcement of traffic laws appears as one of the best deterrents to reckless disregard of safety and the police agency itself must through constant training and retraining remove those causative

factors which lead to a lack of voluntary cooperation by pedestrians and motorists, in the protection of life and property.

Every public-spirited citizen has an interest in police training. The benefits derived from it are constantly being realized through better, more efficient, and more courteous law enforcement service, which in turn insures a safer use of our streets and highways.

Blighted Areas and Traffic

NATHAN L. SMITH

Nathan L. Smith is Director of the Department of Public Works in Baltimore, Maryland. For many years Mr. Smith has been associated with highway improvement in America. After serving as chief engineer for the Annex Improvement Commission, he became Assistant Highways Engineer and later Highways Engineer for the Paving Commission. Later Mr. Smith was Associate Engineer for the City of Baltimore. Later still he served as Chairman and then as Chief Engineer for the Maryland State Roads Commission. Mr. Smith is a member of the American Society of Civil Engineers and of the American Public Works Association. He is President of the Engineers' Club of Baltimore. He served for two years as President of the Municipal Division of the American Road Builders' Association and he is a member of the Board of Urban Consultants to the U. S. Public Roads Administration.

THERE may appear to be little relationship between blighted areas and traffic. Slums and blighted areas are usually thought of as static, while traffic has dynamic characteristics. A more careful analysis, however, indicates that traffic factors have an important influence on the causes of urban blight and must be given careful attention in attempts to remedy slum conditions.

It is a well-established fact that the uses to which land is put are influenced significantly by the transportation pattern. And in this pattern, cities have always been anxious to improve their positions.

In the early days of this country, post roads and water-borne transportation were of greatest importance, and cities sought to improve their economic positions by the construction of canals and improved waterways. Later the railroads became of importance and were encouraged by various forms of subsidies and land grants.

Importance of Transportation Pattern

In fact, Baltimore's concern over the construction of the Erie Canal was so great that the city itself furnished four and a half million

Author's note: The writer gratefully acknowledges the cooperation of Richard L. Steiner, Director of the Baltimore Redevelopment Commission, for his contribution in the assembling and coordination of information contained in this article.

dollars of the early capital for the Baltimore & Ohio Railroad and gave this same company perpetual tax exemption as an inducement to establish its home office in Baltimore on what is now one of the most valuable business corners in the city.

Anyone proposing such assistance to railroads in Baltimore today would certainly make slow progress. But Baltimore is as concerned as ever about retaining a dominant position in the transportation pattern and is currently engaged in spending about $12,000,000 for the development of a large modern airport and is studying a $54,000,000-expressway proposal for the combined service of through traffic and local transportation. Thus, while the modes of travel have changed with the years, every great city like Baltimore must realize the influence of transportation upon its present pattern and future possibilities.

Improved transportation and the concentration of commerce have done much to foster urban growth, and this growth can take place only by the expansion of various types of land uses. While residential areas spread out and capture what were formerly agricultural lands, commercial and industrial areas already surrounded by older residential areas seek expansion by converting these locations to their own ends.

Blighted and Slum Areas

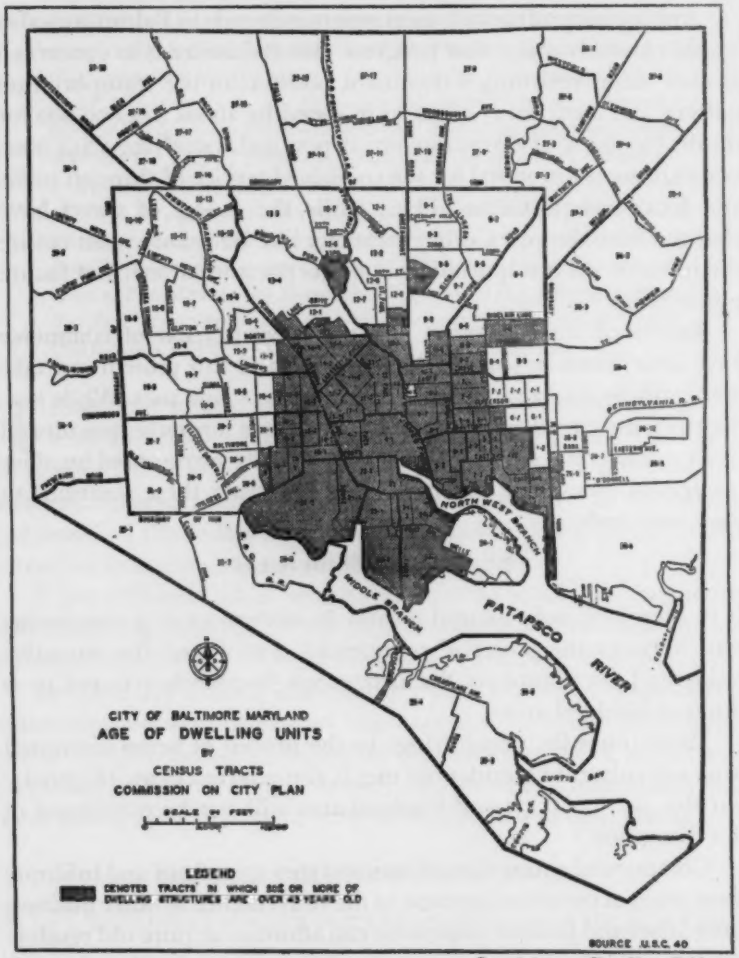
It is, therefore, only natural to find in modern cities a contrasting zone between the powerful commercial centers and the attractive residential developments. Such zones are frequently referred to as slums or blighted areas.

(Sometimes the urban fringe in the process of being converted from agricultural to residential uses is also referred to as "blighted," but this particular type of blighted area will not be considered in this discussion.)

Commercial enterprises of various types spread out and infiltrate these zones of transition because of the convenience to other business enterprises and because commerce can afford to acquire old residential properties as new locations for its activities, while new residential construction can be justified ordinarily only on vacant locations available at raw land prices. Furthermore business establish-

ments are more immune to the effects of their immediate surroundings than are residences of the better type.

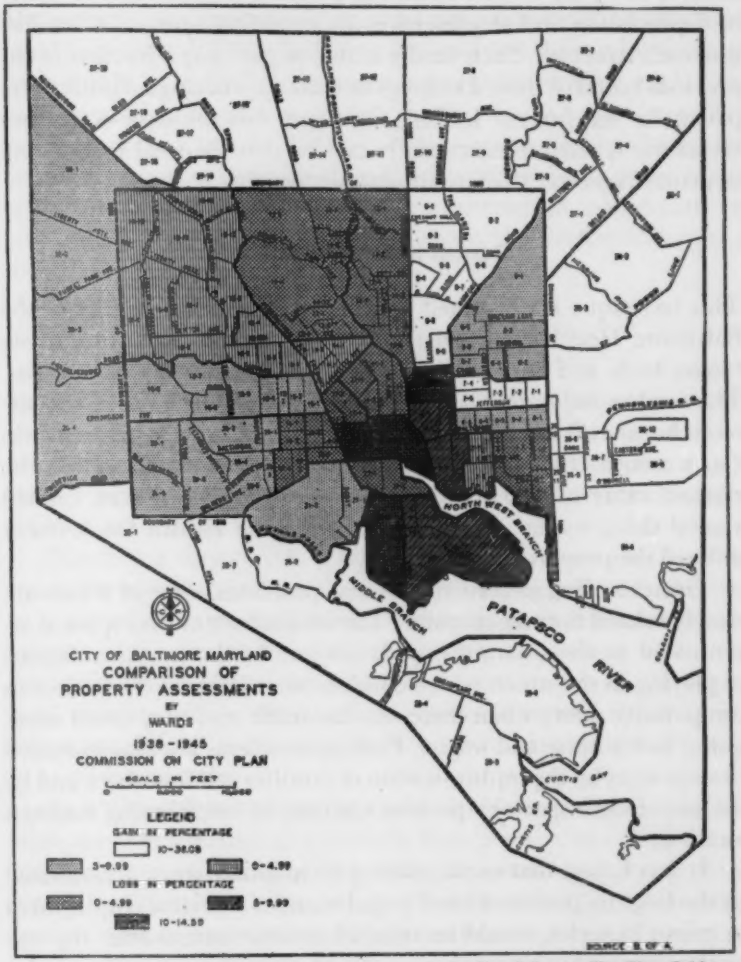
This infiltration of commercial uses into once fashionable resi-



Commission on City Plan—Baltimore

In the older parts of Baltimore, where the majority of the dwelling structures were built prior to 1900, are concentrated the obsolescence and depreciation which cause slums and blight.

dential areas accelerates their decline as desirable locations for homes. Add to this the availability of automobiles and good roads, and the flight to the suburbs has powerful momentum.



Commission on City Plan—Baltimore

The pattern of urban growth is reflected in the trend of assessed real property values. Older central areas generally decline in value, while the vitality and growth of the periphery is reflected in assessment increases.

Old residential areas are abandoned by once well-to-do owner-occupants, and the structures pass into the hands of absentee owners. The primary interest of these owners is in trying to counteract the natural tendency toward declining property income—the corollary of depreciation and obsolescence—by crowding numerous families into each structure. Each family is able to pay only a fraction of the previous rental of these dwellings in their days of single-family occupancy. In the present housing shortage, this multiple-occupancy transition is often so successfully carried that the total income per structure is greater than in the prosperous past.

Results of Overcrowding

This technique is illustrated by a recent case from the files of the Baltimore Health Department in which a house consisting of six rooms, bath, and kitchen was found to be occupied by six families. The total monthly rental being collected was $209. When the six-room house had a single family in it on April 1, 1941, the rent was $20 a month. This new rental of $2,508 a year almost equals the assessed value of $2,640. This particular owner, however, carried a good thing too far with the result that the Health Department ordered the property vacated.

Overcrowding in turn creates new problems, some of which are closely related to those of traffic. The inadequacy of play space is accentuated by the enlarged population and by the increased hazard of playing in the streets where children once enjoyed themselves in comparative safety when there was less traffic and they could move faster than a horse and wagon. Parking problems are also increased in such areas by the multiplication of families resident there and by the use of curb space by persons working in neighboring business locations.

It was hoped that overcrowding in blighted areas, accentuated by the large migration of rural population for war time employment in urban factories, would be relieved to some extent after the war by the return of many workers to their former agricultural pursuits. This relief, however, has occurred to a much smaller degree than was anticipated. City life, miserable though parts of it are, still holds

the same attraction it held for the many who abandoned rural life generations earlier.

A few old city houses have been converted into fairly satisfactory apartments, but this is neither easily nor economically accomplished. Many of these fashionable old town houses were designed for single family occupancy. Their designers assumed that the rambling structures would be staffed by servants at a few dollars each a week. Frequently carriage houses or servants' quarters were built along alley frontages of these lots. No wonder such houses are poorly adapted for occupancy by six or eight families. Owners of these properties, interested only in income and speculative appreciation, spend little or nothing for maintenance, which completes the deterioration commenced by overcrowding.

Effect on the Tax Base

Spreading blight combined with decentralization plays havoc with the tax base of the downtown section in a city like Baltimore. This condition reflects not only the spread of blight but also the migration of purchasing power to the suburbs and a lack of adequate parking facilities in the downtown section.

Disturbing though this trend is in Baltimore, the problem has less acute repercussions on the financial structure than is the case in many other cities. Baltimore is fortunate in that a considerable amount of the new residential construction is occurring within the corporate limits of the city. Even now considerable undeveloped land remains within the municipal boundaries as a result of the extension of these lines in 1918 to increase the city's area from 32.19 to 91.93 square miles.

In addition to overcrowding and declining assessments, blighted areas are characterized by relatively high proportions of old structures and substandard dwelling units, low rentals per family, high population densities, high rates of tuberculosis and juvenile delinquency, and an excessive number of welfare cases.

As has been previously pointed out, the structures in slum areas are predominantly tenant-occupied, and racial minorities congregate in these areas. This racial factor is not so much because of seg-

regation but because prejudice against them in employment limits their earning capacity and their consequent rent-paying ability. In some of these locations, the population is actually declining in spite of the tendency toward overcrowding—a result of condemnation and demolition of dwellings no longer fit or safe for occupancy, and of the transfer of properties from residential to commercial and industrial uses.

Financial Status of Blighted Areas

Furthermore, blighted areas fail to pay their own way in the municipal budget and are a drain on the resources of more prosperous sections. The Baltimore Commission on City Plan has estimated, for example, that, for the years 1943–44, what it defined as the "blighted district," consisting of approximately 9.5 per cent of the city's area, provided municipal income of about $10,700,000. The estimated expenditure on the part of the city in these areas was $25,000,000—a deficiency of $14,300,000, or approximately $2,500 per acre per annum.

The Commission on City Plan has further demonstrated in studies of two sample areas that, while it may not be possible to eradicate this deficiency entirely and place the areas on a completely self-supporting basis, this unfavorable balance can be reduced as a result of rebuilding or rehabilitating the areas.

Available Solutions

So much for the present situation and its underlying causes. It is appropriate to consider now the solutions available and the methods that may be employed in revitalizing delapidated and decaying sections of a large city adjacent to its core.

In doing so it is well to keep in mind the requirements of modern traffic and the secondary effect of traffic upon the design of other facilities. It should go without saying that any attempt to improve these areas should be closely coordinated and controlled by the city's master plan.

What, then, are some of the practical tools and controls available in thwarting and overcoming the costly and unpleasant results of

PLATES

Health Department—Baltimore

Before and after views of a block interior in Baltimore where a vigorous coordinated housing law enforcement campaign was conducted. Note the area opened up for play away from the dangers of street traffic.

Health Department—Baltimore

Baltimore Transit Company

Portion of an experimental parking lot from which shuttle buses are operated to the shopping and business districts of Baltimore. The alley dwellings and general conditions of blight surrounding the parking lot can also be readily seen.

the unrestrained operation of economic law in urban growth? A little reflection indicates that there are many, and that the situation may not be so hopeless as the discussion thus far might seem to indicate.

Zoning Regulation

First, there is regulation by zoning, which is the most important application of the police power in relation to land use. Zoning can dictate where industries and commercial enterprises may be located and can thus prohibit or retard their intrusion into residential neighborhoods. It can even prohibit nuisance industries entirely, and overcrowding can be prevented to some extent by density zoning.

One of the newest ideas in zoning, which gives promise of alleviating the parking situation to some extent, is the inclusion of requirements that off-street loading zones and parking be provided in certain types of new construction according to specified standards. While these zoning controls may not accomplish much in reclaiming areas that are already blighted, they can certainly go far in preventing the further spread of blight. In some instances it may be possible to retard further deterioration of residential areas where other uses have already intruded by rezoning from commercial or industrial to residential use.

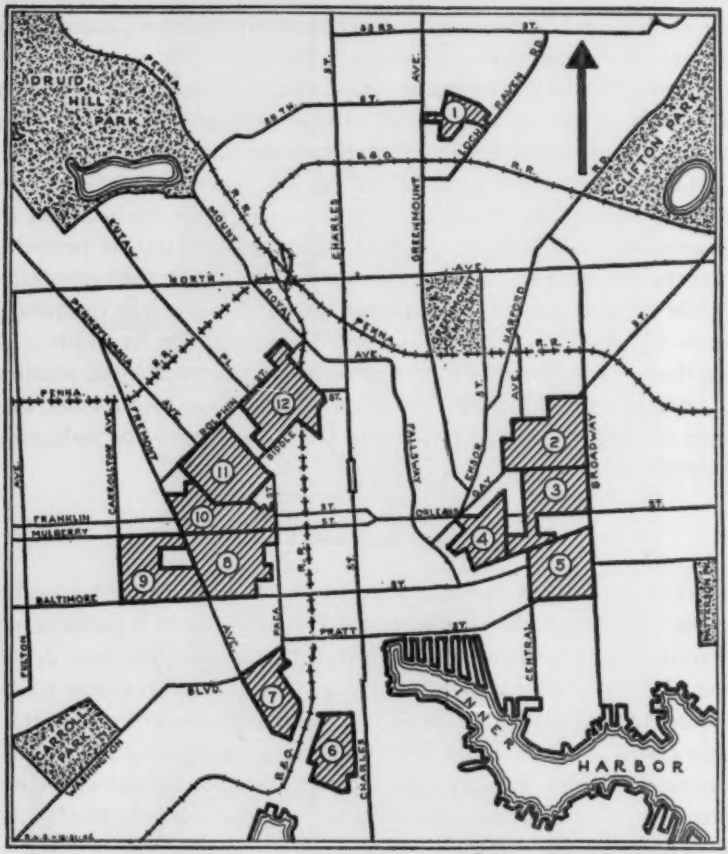
Health, Building, and Fire Codes

Other important exercises of the police power are contained in health codes, building codes, fire codes, etc. In Baltimore a particularly effective and promising application of these codes has been developed by an interdepartmental Housing Law Enforcement Committee. Ordinarily the agencies responsible for the enforcement of such codes consume their time and energy answering complaints scattered all over the city and without any coordinated effort between the various departments. In the end, no concrete results can be demonstrated.

But in the program now in operation in Baltimore and just emerging from the experimental and demonstration stage to a broader application, simultaneous inspections are made by all de-

partments concerned in certain specified slum blocks. Enforcement is vigorously pushed until the blocks have been improved to a minimum standard.

Owners who originally showed considerable reluctance toward following the instructions sent them are now beginning to cooperate with the program more satisfactorily. A fine of $450 recently assessed



Baltimore Redevelopment Commission

Twelve areas in Baltimore totaling 650 acres have been recommended for redevelopment by the Commission on City Plan and Redevelopment Commission. These areas are in the transition zone between the central business district and areas of acceptable housing.

by the Criminal Court against an owner who persisted in disregarding the notices of the Health Department should do much to strengthen cooperation.

The housing law enforcement approach to the improvement of slums has the advantages of effecting considerable improvements at a relatively small expense to the city and without displacing families occupying the premises. It should not, however, be considered the cure-all for the slum problem. In many cases the houses are patched up sufficiently only to extend their usable life for a few years.

Furthermore, the housing law can do nothing about removing the undesirable characteristics of neighborhoods resulting from mixed uses. It is limited in the extent to which it can go toward providing the type of community facilities required especially by families of low income. There is also some question as to how successful the city may be in forcing landlords to spend large sums on their properties in times when their operation is less profitable.

Enforcement does, however, hold great promise as an approach suitable for immediate application under present circumstances. It is interesting to note that it is possible not only to improve the dwelling structures themselves but also the interior of the blocks so that children have more adequate play areas away from the dangers of street traffic.

Public Improvement Projects

Blighted areas can, of course, be improved or rebuilt also by the direct expenditure of public funds. In some cases additional school facilities are required because of an increased population from overcrowding. In other cases, new schools cannot be justified, even though the old ones are thoroughly obsolete, because of the decreasing population and the capture of the neighborhood by nonresidential uses.

Additional park and recreation space are often sorely needed in slum areas, but they are hard to achieve because it is difficult to obtain sufficient funds to develop many new facilities of this type in areas of high land values. Street widening, off-street parking, and express arteries may also be projected in these areas.

The voters of Baltimore approved a $1,000,000 bond issue for

off-street parking facilities at a municipal election on May 6. It is questionable, however, that this money will be spent in blighted areas, as the greatest need for such facilities is nearer the centers of business and shopping districts. There is, however, a type of parking facility particularly well suited to location in the blighted areas surrounding the central business district. This is the perimeter parking lot where suburbanites may leave their cars and proceed via shuttle bus to the center of the city. One such experimental parking lot has been operated by the Baltimore Transit Company in a blighted area for about a year, and the experience indicates considerable public acceptance.

Public Housing

The most spectacular attack on slums to date has been the public housing projects administered by local housing authorities with the financial assistance of the Federal Public Housing Authority under the U. S. Housing Act. These projects have not only done away with many acres of the most undesirable blighted areas but the projects also are capable of housing former slum residents or families with incomes so low that they could otherwise afford only substandard quarters.

Public housing procedures furthermore offer an opportunity for real community living which has all too often been supplanted by loneliness and anonymity in the great cities. The plans usually provide off-street play and parking areas, and not infrequently have resulted in closing unnecessary streets and alleys and in widening or realigning major thoroughfares.

Urban Redevelopment

Realizing the desirability of enlisting private capital and enterprise in the great task of rebuilding and modernizing blighted urban areas, a number of cities have now begun to establish redevelopment programs under special commissions and authorities. In general, these agencies can assemble relatively large tracts of land in blighted and slum areas with the power of eminent domain—not ordinarily available to private enterprise—and then can sell or lease such areas for

redevelopment by individuals or corporations in accordance with standards and plans established and approved by the public agency.

Practical redevelopment programs will, in most instances, require public assistance of one type or another, such as some form of tax relief or an initial write-down of the land acquisition cost at public expense. This write-down can in turn be financed either by bond issues or by pay-as-you-go appropriations. In Baltimore, the Redevelopment Commission favors initial write-down by public assistance because it involves more straightforward bookkeeping, eliminates justification for a redeveloper to overcrowd the land, and reduces the amount of equity capital required for the new undertaking.

While redevelopment has a proper place among the tools for repairing broken down urban areas, it also has limitations. One of the most serious is the inability to solve the problem of housing families already living in the areas. It can, however, be used to combat decentralization and to control in a more orderly fashion the transitions that take place in the dilapidated sections of a city.

Potentialities of Blighted Areas

It is well to consider also the potentialities of blighted areas, as confused thinking on this subject is frequently encountered. Many persons assume that blighted areas which are largely residential in character should naturally be replanned for residential purposes. This is one of the limitations of the public housing process. It is entirely possible and, in many cases probable, that blighted areas should be *discontinued* for residential use. Many such locations because of the development of nearby land or the infiltration of business and industry should be permitted to follow the pattern already being imposed upon them. In slums adjacent to railroads it may, for instance, be most logical to redevelop for industrial purposes or warehouses.

Since present thinking is in favor of routing intercity highway traffic through or near the centers of urban areas rather than via by-pass roads, it appears likely that locations through blighted areas will be sought for express highways. In Baltimore, for instance, the

latest crosstown expressway plan traverses three proposed redevelopment areas, and the location of this type of facility through such areas will undoubtedly have a marked influence upon their future. Not only will they open up swaths of light and air in the most thickly congested sections of the city and provide frontage locations with a relatively pleasing outlook, but there is also the possibility that land adjacent to the points of ingress and egress will have a special value for activities served by long distance motor freight.

There will be possibilities for interchange terminals where expressways cross or pass close to piers or railroad yards. It is also probable that the superimposition of an expressway on the conventional street pattern may suggest more efficient realignment of local streets when redevelopment takes place. It is unwise to be too enthusiastic on this score, however, for street relocations and abandonments which may look relatively feasible on the ground or on a general plan are often ruled out by the costs and complexities of relocating utilities after sub-surface surveys have been made.

Conclusion

In considering the problem of blighted areas it is well to remember that these areas result from natural trends. One needs to understand the economic laws that brought about the blight. In projecting improvements to such areas these laws must also be understood. What appears to be the natural economic destiny of any particular location must be carefully respected. For while conscious planning can hasten the operation of such laws and reduce the losses they ruthlessly impose, any disregard for them will usually result in unsound development.

Street Lighting Correlated with Tree Management

EDWARD H. SCANLON AND KIRK M. REID

Mr. Scanlon is editor of Trees Magazine. Mr. Reid is head of the Street Lighting Section of the Engineering Division of the General Electric Lamp Department. Mr. Scanlon was City Forester of Santa Monica, California, a forester in the California Division of Forestry and in the Landscape Department of the California Division of Highways. He is also Commissioner of Shade Trees for Cleveland, Ohio. Mr. Reid is a member of the Illuminating Engineering Society, a member of the I. T. E. and of the American Public Works Association. His researches on factors affecting visibility on lighting streets, and his development of instruments and techniques for evaluation of street lighting, have contributed importantly to modern street lighting technology. This article was presented before the National Conference of the Illuminating Engineering Society at New Orleans last month.

STREET TREES, properly selected and located and cared for, provide distinctive grace and matchless natural beauty. They temper summer heat. They stimulate civic pride. They help to stabilize real estate values. They are, indeed, indispensable municipal assets.

Street lighting, properly designed, installed and maintained, safeguards and facilitates the movement of vehicles and pedestrians at night. It deters crime. It stimulates civic pride. It helps to stabilize real estate values. It, too, is an indispensable municipal asset.

Through understanding and cooperation of those responsible for street trees and street lighting, these two municipal assets need not conflict. On the contrary, each may supplement the other to their mutual advantage.

Can street trees actually *increase* the effectiveness of the street illumination? Yes, in two respects, where the cones of foliage conform to the cones of light distribution from the street lamps. First, foliage midway between street lamps and somewhat below lamp

level tends to screen distant light sources. The attendant reduction in glare enhances the visibility and comfort of both motorists and pedestrians. Such a gain is particularly important on local-traffic residential streets where limited funds usually require relatively wide lamp spacings, with correspondingly high candlepowers at angles near the horizontal.

Second, some upward light is reflected by foliage downward to the street and sidewalk. The amount of this reflected light is usually small, yet the measurements made for this paper show it is likely to be quite significant at the low levels of illumination on local-traffic streets. A further comment might be made that by day a street has a much more pleasing appearance if distant street lamps and brackets and poles and wires are screened by foliage.

And what, in return, does good street lighting do for the trees? After darkness has fallen, it simply continues to reveal a portion of their natural beauty. Hours during which they fulfill their aesthetic purpose are thus extended.

In short, by harmonious joint use of the streets for beauty and for utility the objective of greatest service to the public at lowest cost may be attained.

Shade Tree Practices in the Past

All too often the management of street trees has been unsound in two respects—poor and narrow selection of species and varieties, and crowded plantings.

In selections over-emphasis has been placed on rapidity of growth and low cost of nursery stock. True, by so doing a quick showing at low initial cost has been achieved. But as these "weed types" have grown the penalties of heavy costs of care and serious interference with utilities have far overbalanced any temporary advantage they may have had. In contrast, far-sighted arborists are making selections based on trees which fit the street space available and hence require little pruning to maintain normal and desirable contours, soil condition and room available for root system, exposure, minimum conflict with utilities, and other considerations which in the long run determine both beauty and cost.

Nearly always trees have been planted much too close together. Arborists know this. Yet a home owner usually demands at least one tree in front of his home, and in many cases two, regardless of the lot width. Where these ill-considered demands have been heeded, the trees become too crowded for beauty or health.

The expense of this sort of tree management has been great. Where half the trees were superfluous—the typical case—the original cost was doubled. Then the maintenance cost was doubled up to the time where crowding and resulting nuisances brought on premature removals. These removals—the straws that break the backs of budgets—might have been delayed ten or twenty years or more by proper spacing and selection.

The remedy is education of property owners, and a firm policy by the city arborists to do the job correctly. The street must be the unit, not the individual property. And only enough trees must be planted to obtain the highest degree of beauty of individual trees and the street as a whole. And incidentally, this practice means less conflict with utilities.

Meritorious Species and Varieties

In order to meet space requirements, upright and globe varieties as well as "normal" species are needed. "Bud sports," from which desired varieties may be propagated, occur in many species. On narrow streets it is usually better to use upright varieties exclusively. On wide streets the species may predominate with its upright variety at corners and near street lamps. Where there are telephone or electric service lines along the street the globe or upright varieties may permit running the wires above or to the side of the trees, respectively.

The upright or fastigiate forms particularly warrant greater attention. They usually have a spread not more than 15 feet in diameter, with a mature height of 35 to 40 feet. Globe forms have a spread of about 25 to 30 feet, and a mature height of 30 to 35 feet. In comparison, the corresponding species have spreads in the range of 40 to 75 feet, and mature heights from 65 to 125 feet.

Two species excellent for streets are available in all three forms

—normal, upright, and globe. These are the Norway maple (Acer platanoides), and the European elm (Ulmus carpinifolia). Every American municipality in which soil and climate permit should make use of these six trees.

The Norway maple has a wide range of use, climatically and from the standpoints of tolerance of atmospheric and soil conditions. The European elm is a prolific producer of sports and endures city conditions better than its American cousin, principally because of the smooth character of its leaf. The chief varieties are the Wheatley elm (Ulmus c. sarniensis), the Globe-headed elm (U. c. umbraculifera), and the upright Golden elm (U. c. Wredeii).

Five other species excellent for streets are available with upright varieties. These are the Sugar maple (Acer saccharum), the American elm (Ulmus Americana), the English oak (Quercus robur), the American Red oak (Quercus rubrum), and the London Plane or Sycamore (Platanus acerifolia).

The upright Sugar maple is not too tolerant of adverse atmospheric and soil conditions. But where a favorable site is available it makes a beautiful tree with a tight upright form that is low in maintenance.

There might be some question in using the upright form of American elm (Ulmus Americana ascendens) because of the afflictions to which the family is subject. However, there are parts of the country, out of the "danger zones," where it should have high priority.

The English and Red oaks are both long-lived beautiful trees, and with their upright varieties (Quercus robur fastigiata and Quercus rubrum fastigiata, respectively) endure many hardships imposed on city trees. They do well in a wide range of soils, but are touchy in adverse atmospheric conditions.

Early this year the Cleveland Division of Shade Trees ran down a source of supply of a variety that should prove to be a valuable addition in the planning of streets. It is the upright form of London Plane. The search for this tree failed to disclose a single specimen in cultivation in this country. After six months of intensive effort six trees were obtained from a nursery in Belgium. They are true uprights.

The above species may well be supplemented by three others, of which upright varieties are available. These are Ginkgo (Ginkgo biloba) and Red maple (Acer rubrum) for northern climates, and Magnolia (Magnolia grandiflora) for southern.

Two other species warrant attention—Goldenrain (Koelreuteria paniculata) and Chinese Scholar (Sophora japonica) tree. The Goldenrain is at present available only in normal contour. An upright variety, however, is known to have been produced, and it is to be hoped that it can be found somewhere in the world and established in cultivation in this country. *The* Chinese Scholar is in process of breeding and selection by the Cleveland Division of Shade Trees in an attempt to develop a strain that is *entirely* hardy in northern latitudes, and a search is being conducted to find an upright variety, also *known* to exist.

Arborists are aware that assurance of availability of the desired varieties, properly trained for street use, requires arrangements several years in advance of need. Such arrangements may be made with state or national nursery associations. Or stock may often be grown to best advantage in the municipal nursery.

With such a fine kit of tools the arborist has a wide range of happy choices in laying out his master street tree plan. Not only can he tailor the contours to fit the space available, but also he can introduce harmonious variations in leaf texture—for example, Norway maples interspersed with Sugar maples.

Is it ever preferable to plant street trees back of the sidewalk instead of in the "tree lawn" between sidewalk and curb?

The advantages are a wider street vista, a more "natural woodsy" appearance if the trees are planted in irregular arrangement rather than in a row, and reduced interference with such utilities as may be located in the tree lawn both above and below ground. The disadvantages are that the city arborist must obtain the approval of each property owner on the number, variety, and location of trees to be planted on his property. This is time-consuming, to say the least, and unless all property owners cooperate the street cannot be planted as a unified whole. Further, there are basic legal questions as to the responsibility and authority for tree care and removals.

Pending further experience and legal precedents, plantings back

of the sidewalk probably will seldom be considered except where insufficient tree lawn space leaves no other possibility of planting.

Long-Range Planning

The following steps are suggested to the responsible municipal and utility officials in development of a joint long-range plan for street tree management and street lighting:

1. Preparation in broad outline of two plans for the municipality—a master street tree plan, and a comprehensive street lighting plan.

The master street tree plan[1] includes selection of a range of species and varieties suitable for the municipality, and their broad assignment to meet the requirements of diverse street conditions.

The comprehensive street lighting plan[2] includes classification of all streets in terms of vehicular and pedestrian traffic, and adoption for each street classification of a standard lighting system including type of light distribution, mounting height, spacing, transverse position, arrangement, and lamp size.

2. Selection of typical "trial streets" and preparation of tentative "ultimate" detailed layouts of street trees and street lighting for those streets.

3. Consultation on the detailed layouts, and revision to provide for maximum overall beauty and utility. The authors believe any conflicts can always be worked out satisfactorily through an understanding of the reasons underlying the detailed layouts and by relatively minor revisions.

4. Completion of "ultimate" detailed layouts of trees and lighting for all streets in accordance with the trial streets, and joint approval of the layouts by the responsible officials.

5. Formal adoption of the detailed layouts by the municipal administration or planning commission.

6. Strict adherence to the plans in all tree plantings and lighting additions or changes.

[1] "Some Factors in the Planning and Management of Public Trees," Edward H. Scanlon, Proceedings, 18th National Shade Tree Conference, Western Chapter, 1942.

[2] "Recommended Practice of Street and Highway Lighting, 1945." *Illuminating Engineering*, February, 1946, p. 105.

7. Periodic consultations reporting progress toward the "ultimate" layouts, and joint action on any modifications in plans resulting from new knowledge or changed conditions.

Handling Existing Plantings

The prospects of long-range alleviation of friction between trees and lighting are bright. But what about existing conflicts? In most cases, the answer is proper pruning.

Pruning may be defined as the art of correcting, stimulating, and forming street trees. Done correctly, by men trained in its purposes and techniques, it is beneficial to the trees. Conversely, pruning incorrectly done may injure a tree's health and detract greatly from its beauty.

Few trees will stand a heavy removal of foliage. This destroys the balance between roots and foliage, and dieback of the root system occurs. The excess food stored in the cells tends to replace the lost foliage, which throws an overload on the reduced root system. Twig and limb dieback follows, sometimes with loss of the tree.

Another damaging effect of drastic pruning—whether it be radical opening of the crown, excessive lifting of low branches, or severe pruning of laterals—is danger of excessive transpiration, sunburn or winter injury. These injuries lead to invasions by borers or other insects and fungous diseases.

Where a tree conflicts seriously with a utility service, often the best remedy is removal of the conflicting tree. This is particularly likely to be true in the typical case where the trees are too crowded anyway. There are usually two alternatives.

One is relocation of the poles or wires or street lamps involved; sometimes this can be done without impairment of the utility service, but often it cannot. The other alternative is mutilation of the conflicting tree. Beautiful trees are the arborist's goal, and in a majority of the conflict sites appearance would be best served by judicious removals. If gaps are thereby created, they can be filled by upright or other varieties conforming to the ultimate plan.

Types of Street Lighting Luminaires

Two types of street lighting luminaires are likely to be encountered in any study of the pruning needed by existing plantings to minimize foliage interference with street illumination. One is the upright type of luminaire, located a foot or two back of the curb, usually at mounting heights of 10 to 15 feet on local-traffic residential streets and 15 to 20 on arterial streets. The other is the pendent type of luminaire, usually suspended on a bracket 5 to 10 feet beyond the curb out over the pavement, at mounting heights of 20 to 25 feet on local-traffic residential streets and 25 to 30 feet on arterial streets.

Modern pendent luminaires are radically superior to the upright type in visibility provided per dollar of total lighting cost. Several factors combine to produce this superiority: (1) Modern pendent lighting systems direct to the pavement almost twice as much light as do the most effective upright types employing the same lamp wattage. (2) The high mounting of modern pendent luminaires substantially reduces glare. (3) The high mounting also markedly improves the spread of light up and down the street. (4) On wet pavements, luminaire position out over the pavement becomes paramount in order that the streaks of brightness, on which wet-pavement visibility so greatly depends, largely cover the pavement.

In summary, under typical street conditions the overall lighting effectiveness of a modern pendent system is of the order of 3 times that of an upright system of equal total cost. Municipal officials responsible for public safety and for balancing of budgets are naturally insistent on having the benefit of this technological advance.

In regard to street trees, low upright types of luminaires have less foliage interference under some tree conditions and high-mounted pendent types out over the pavement have less under others. By and large, the pendent luminaires encounter less conflict because their bracket mounting usually removes them 15 to 20 feet or more from the line of tree trunks. Further, their position out over the pavement throws tree trunk shadows diagonally *across* the sidewalk; in contrast, tree trunks shadow the sidewalk much more heavily with upright luminaires near the line of trunks.

Examples of Proper Pruning

Four Cleveland streets were selected for use as examples of proper pruning. The pruning, in the opinion of the arborist-author and his staff, was in each case beneficial rather than detrimental to the individual trees involved. Further, they consider that the streets after pruning had a neater, better appearance. And the lighting measurements showed substantial gains in visibility.

West 14th Street is a medium-traffic artery with 50-foot pavement. The trees are predominantly London Planes, with some American elms and Lindens, all 35 to 40 years old. The lighting consists of modern pendent luminaires 25 feet high on the test side of the street and pre-war pendent luminaires 20 feet high on the far side, 2 feet out over the pavement, in staggered arrangement at an average spacing of approximately 95 feet, and with 6000-lumen lamps.

West Boulevard is a medium-traffic arterial parkway with 40-foot pavement. The trees are London Planes, approximately 30 years old. They have been neglected for many years. The lighting consists of old lantern-type luminaires 18 feet high, located above the curb line, in one-side arrangement at an average spacing of 190 feet, with 6000-lumen lamps.

East 174th Street is a local-traffic residential street with 28-foot pavement. The trees are American elms and Silver maples, 60 to 75 years old. The lighting consists of modern pendent luminaires 26 feet high, 10 feet out over the pavement in staggered arrangement at an average spacing of 290 feet, with 6000-lumen lamps.

East 117th Street is a local-traffic residential street with 25-foot pavement. The trees are Sugar maples and some Silver maples, approximately 40 years old. The lighting consists of efficient pre-war pendent luminaires 21 feet high, 4 to 10 feet out over the pavement in one-side arrangement at an average spacing of 300 feet, with 4000-lumen lamps.

Table I presents measurements made on these four streets with the Street Lighting Evaluator[8] under three shade tree conditions—in winter before pruning, in summer before pruning, and in sum-

[8] "A Street Lighting Evaluator," Kirk M. Reid and H. J. Chanon, Trans. I.E.S., January, 1940, p. 72.

mer after pruning. The Street Lighting Evaluator measures the three principal factors in visibility[4] on lighted streets—pavement brightness, obstacle brightness, and glare. The Evaluator Rating is a relative scale providing direct numerical comparisons of the "net glare-free illumination" obtained from different lighting installations.

TABLE I

STREET ILLUMINATION AS AFFECTED BY TREE PRUNING
MEASUREMENTS ON FOUR HEAVILY PLANTED STREETS
IN CLEVELAND, OHIO

	STREET LIGHTING EVALUATOR RATINGS	
	AVERAGE	MINIMUM
West 14th Street, arterial street		
Winter, before trimming	4.1	2.9
Summer, before trimming	3.2	1.6
Summer, after trimming	4.5	2.7
West Boulevard, arterial parkway		
Winter, before trimming	6.4	1.8
Summer, before trimming	6.0	1.1
Summer, after trimming	7.0	2.2
East 174th Street, local-traffic residential street		
Winter, before trimming	2.6	*
Summer, before trimming	2.5	*
Summer, after trimming	3.7	*
East 117th Street local-traffic residential street		
Winter, before trimming	3.1	*
Summer, before trimming	2.8	*
Summer, after trimming	3.7	*

* Below scale of Evaluator Ratings.

As would be expected, the *average* Evaluator Ratings were in all cases the lowest in summer before pruning and highest in summer after pruning, with the winter condition between these two. This same relationship applied to the minimum Evaluator Ratings on West Boulevard. On West 14th Street, however, the minimum

[4] "Evaluation of Street Lighting," Kirk M. Reid and H. J. Chanon, Trans. I.E.S., December, 1939, p. 1209.

Evaluator Rating was slightly higher in winter than in summer after pruning. The reason was that a little foliage interference remained after the trees had been pruned as much as the arborists considered proper from the standpoints of tree health and appearance. Further pruning in two or three years would be expected to eliminate the remaining conflicts.

The general result on the four test streets was that pruning increased the average lighting effectiveness approximately one-third, and approximately doubled the lighting effectiveness in the critical areas of low visibility.

These gains in lighting effectiveness may be considered representative for heavily planted streets. Less gains are to be expected on lightly planted streets. Conversely, greater gains are to be expected on many urban streets where crowding and poor selection and neglect of pruning have produced foliage interference far greater than that on the four test streets.

It is interesting that particularly on the two local-traffic streets the street lighting measurements were not much lower in summer before pruning than they had been in winter. This held true in spite of the fact that several leafy branches before pruning intercepted considerable light, as the after-pruning data show. Nevertheless this interception apparently was compensated for in large measure by reflection of upward light down to the roadway by the "ceiling" of leaves. The authors intend to test the validity of this explanation by repeating the measurements this fall after the leaves have dropped.

Conclusion

People want street trees. They also want utilities. Only through understanding and cooperation can they have both in full measure.

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The authors acknowledge their indebtedness to William Brezine of the Cleveland Division of Shade Trees for assistance in selecting test streets and supervising pruning; to R. J. Diefenthaler and A. F. Nies of the Nela Park Engineering Division for Street Lighting Evaluator measurements; and to others in the National Shade Tree Conference and the Illuminating Engineering Society who assisted in planning and conducting the tests and in preparation of the paper.

PLATES

OLDER-TYPE LIGHTING IN SUMMER BEFORE PRUNING

OLDER-TYPE LIGHTING IN SUMMER AFTER PRUNING

NEWER-TYPE LIGHTING IN SUMMER BEFORE PRUNING

NEWER-TYPE LIGHTING IN SUMMER AFTER PRUNING

STREET OF UPRIGHT AMERICAN ELMS

STREET OF UPRIGHT SUGAR MAPLES

Uniform Traffic Law Enforcement in Michigan

MAXWELL HALSEY

Mr. Halsey is Executive Secretary of the Michigan State Safety Commission. He has served as Secretary of the Uniform Enforcement Police Sub-Committee of the Safety and Traffic Committee of the Michigan Association of Chiefs of Police and is reporting this development in its behalf. This committee is composed of C. J. Scavarda, Commanding Officer, Traffic and Operators License Division, Michigan State Police, Chairman; Chief Howard Hoyt and Lt. Melvin Beardsley of Kalamazoo; Chief Harold E. Hahn and Captain George Cheek of Battle Creek; Chief George H. McNicoll and Sergeant Rudolph Nagel of Saginaw; Chief Frank Anderson and Lt. Wm. S. Rosebush of Bay City; and Chief Harry H. Bailes and Captain William Thompson of Jackson.

MICHIGAN'S new method of uniform traffic-law enforcement has produced very satisfactory results. A nine-months comparison in five pilot cities showed that moving violation cases resulting in a fine increased from 1576 a month to 1975 a month. This suggests that warnings were not substituted for fines. Officer-violator contacts increased from 1576 a month to 2254 a month.

Personal injury accidents in the five pilot cities decreased 3.1 per cent (September 1946 through May 1947 compared to the same months of the previous year) whereas the seven other comparable cities in the state increased 2.8 per cent. This showed a 5.9 per cent better record for the pilot cities. The six cities of comparable size in the Detroit metropolitan area (excluding Detroit) showed an increase of 6.2 per cent. This gave the pilot cities a gain of 9.3 per cent. This gain plus many other values has resulted in ten additional cities making the decision to adopt the plan at a meeting on July 8, 1947.

For more than two years, the police of Michigan, working through their association, have worked to develop a traffic law enforcement system that would make uniform traffic law a reality from the motorist's point of view. On June 13, 1945 a large group of police and

safety officials met with Daniel G. Reynolds, Assistant Director of Field Service of the Traffic Division of the International Association of Chiefs of Police and launched the development work. After twenty meetings and ten complete redrafts of the materials a thirty-one page training manual was printed in July of 1946.

The committee authorized Bay City, Saginaw, Jackson, Battle Creek, and Kalamazoo to serve as "pilot cities" and install the system to work out any practical difficulties. In each city the plan was presented before a meeting of the "official family" composed of the mayor, city manager, chief of police, judge, city attorney, prosecutor, and editor of the local newspaper. It was felt that it would have been unwise to launch a completely new system without the advice of these persons. In each case the response was enthusiastic.

A team of trained instructors was then assembled to assist local instructors and give maximum consistency to training schools in each of the five cities from July 8 to July 18, 1946. This team was composed of Gordon Sheehe, assistant director of training of the Traffic Institute of Northwestern University, Captain C. J. Scavarda, commanding officer of the Traffic and Operators License Division of the Michigan State Safety Commission. Every officer of each local department received 12 hours of instruction spread over six days.

The system was then begun in the middle of August, 1946. After six months' experience in which the system worked well, all officials were pleased. The accident experience was better than in comparable cities not using the system. The Michigan Association of Chiefs of Police formally approved, endorsed and recommended the system on April 2, 1947, as follows:

> Therefore, the executive committee of the Michigan Association of Chiefs of Police does now formally approve, endorse, and recommend the Uniform Enforcement Policy for all of Michigan's law enforcement agencies and hereby authorizes the Safety and Traffic Committee to assist any department that expresses a desire to install the system through holding conferences with the proper officials and participating in the six-day training schools necessary to prepare all officers to apply the system.

On June 7, 1947, the Michigan Association of Municipal Judges endorsed and recommended the system. The approval, endorsement, and recommendation of the system by the two state associa-

tions of chiefs of police and judges placed a large group of law enforcement officials solidly behind it.

On July 8, 1947 a meeting of the Chiefs of Police and heads of Traffic Divisions of ten of the remaining larger cities of Michigan resulted in the following chiefs deciding to install the system this winter with training schools scheduled for January, 1948. These cities were: Grand Rapids, Lansing, Pontiac, Ann Arbor, Port Huron, Monroe, Hillsdale, Benton Harbor, East Grand Rapids, and Midland.

Chiefs of police from Muskegon, Muskegon Heights, Owosso, and St. Joseph had previously expressed their desire to adopt the system. Thus, the status of fourteen additional cities appears to be clear. The interest at this meeting was so great that the police administrators present voluntarily expressed the desire to contact the other cities adjacent to them to see if they would not like to come in at the same time. They listed eighteen of such conveniently located cities. If all of these came in, there would be a grand total of thirty-seven Michigan cities using the system early in 1948.

Thus, a little over two years after this cooperative development work began, almost all of the larger cities outside of the Detroit metropolitan area will be using a uniform traffic law enforcement system. (Because of the size of the problem of records, etc., in Detroit, it was believed sound policy to apply the system first in large out-state cities, and when conditions are appropriate, to work with the twenty-nine Detroit metropolitan area cities simultaneously when all of their department heads feel that they are ready for it.)

Why the System Was Developed

Numerous police officials became increasingly aware at the close of the war that there would be a considerable increase in the factors that cause accidents. To offset these factors, it was obvious that police would have to develop more effective accident prevention measures. Otherwise, *accidents* would increase.

In discussing ways and means of developing a more vigorous and more effective traffic-law enforcement program, these officials recognized the almost complete lack of uniformity in the interpretation

and application of traffic law by chiefs of police and individual officers. Until this situation could be improved, they were reluctant to step up the operations. The lack of uniformity was not the fault of individual chiefs or officers, it was reasoned, but was due rather to the lack of agreement on what action to take and when to take it, and the lack of a system on which all could agree—a system that would make the basic idea of uniformity workable.

The logical thing to do, therefore, was to develop such a system.

The administrators were highly conscious of the fact that motorists were not much interested in "uniform law" when each officer treated them differently. If it could be arranged to have individual officers give uniform treatment to violators, public relations would improve, support for the police department would result.

The chiefs knew also that an essential element in a more effective enforcement program is to increase the number of officer-violator contacts. But this increase should be on a basis acceptable to the public; and to solve that problem, the chiefs knew, greater consistency and uniformity than at present were necessary.

Lastly, these law enforcement officials recognized the simple fact that if they could band together and agree on one uniform system, it would place their respective departments in a stronger position with local people than if they each developed a strictly local program having nothing to do with the other cities in the state.

Therefore, the new system was developed—to develop better methods for the future, to provide practical uniformity of enforcement, to bring about an acceptable method of increasing the number of officer-violator contacts, and to secure the added strength of working together.

What the New System Is

Because one of the main reasons for its development was uniformity and because it produces uniformity, the new system was given the title, "A Uniform Enforcement Policy." Actually the new system, in accomplishing uniform action in similar situations, contains other important elements essential to the objective. Among the ten more specific parts of the system are the following:

1. It provides uniform consistent action by individual officers

through providing a uniform guide for their actions. It shows that police executives have given clear and intelligent thought to this major problem.

2. It tells the people of the state that the police present a united front on the attack against accidents.

3. It does a safety educational job through the use of a two-color traffic violation notice ticket which is a "sales piece" as well as a legal document.

4. It does a selective enforcement job by printing the six most important violations and the six most important conditions as determined by agreement of the participating officials.

5. It creates a system of written warnings for "first offense" relatively minor violations and a mandatory trip to headquarters to have previous records checked.

6. It provides a hazard rating scale to screen out the minor cases for warning treatment and assist in evaluating the degree of threat against public safety of the more serious cases, thus, making it possible to determine accurately the proper amount of each fine.

7. It puts into print something specific on which the court can cooperate with the police.

8. It puts into print the policy of the police department thus making it much easier for each officer and each motorist to understand exactly what the policy is compared to a policy based on occasional verbal statements.

9. It gives positive direction through printed instructions to police officers and thus greatly facilitates training.

10. By becoming specific in directing police actions, it makes it easier to explain to the public what the police are trying to do.

The Form Prepared for Uniform Use

The heart of the new system is a traffic ticket which all cities having the system use in exactly the same form. This ticket is the outward symbol of uniformity to the motorist and to the officer. It is called a "Traffic Violation Notice." It notifies the violator that he has broken the law and must make a trip to the Violations Bureau court or police department where he may either receive a warning or pay

a fine depending upon the degree of the relative seriousness of the offense and whether or not it is a first offense.

The appeal to the violator has been increased by printing the ticket in two colors rather than in black. The six principal violations which, the administrators agreed, caused most accidents are printed in red. After each violation there are printed, with boxes for checking, the three most common maneuvers that represent violations. These are in three columns reading from left to right, (1) least serious, (2) more serious, (3) most serious. A space is left blank for "other violations."

Conditions that increased the seriousness of the violation are also printed in red with boxes for checking.

These items in red, placed in red boxes, are a strong reminder to both motorist and officer of the things the department considers especially important.

The rest of the printing on the ticket is in green ink. This is an attractive color and makes the officers' black pencil writing easier to read than if black ink were used. The tickets come in books of twenty-five sets of original and two carbons. Identification information—minimum data on the violator's copy for *residents,* and added information on the department's copy for *non-residents*—includes all facts shown on the Michigan drivers' license.

These tickets were obtained from the R. P. Lewis Company of Lansing, Michigan, at a cost of $13.74 a thousand in books of 25 sets a book. This company cooperated in the layout and type-setting arrangement of the ticket and provided them for all five pilot cities.

The Big Six Violations and Conditions

The reason the system was not applied to all violations was that it was far easier to develop the system on a small number of cases. It was therefore agreed to start with the six violations causing the most difficulty and later to expand the plan to other violations.

The six selected were those causing most accidents—those listed as a contributing factor in 80 per cent of the accidents according to state-wide records. This meant that if officers do a good job of selective enforcement regarding the offenses, that in only one-fifth of their stops would they have to write in the name of the violation.

In the rest of the cases the officer would merely check the appropriate box or boxes. The violations themselves were broken down into specific driving acts. This makes the offense clearer to both the violator and the officer and it more accurately describes the violation than would a more general charge. This listing of specific actions does what any officer would do anyway. But different officers might describe offenses differently, unless terms and acts are previously agreed upon.

The conditions listed were those that judges generally take into consideration in hearing a traffic case. By being specifically listed the judge gets more specific information than from an officer's longhand report. The fact that conditions are actually printed on the ticket informs the violator that both the police department and the court consider them important. Hence, the violator will expect these conditions to be taken into account if he is arrested. This has a good educational effect.

Most large cities have parking meters and a special police parking detail to handle overtime parking. A special parking ticket is therefore recommended in these cases. In this way, officers dealing with moving violations will have only occasional parking cases. These they can enter on the line titled "other violations," or carry a parking violation book also.

The Hazard Rating Scale

It has been generally agreed that the more dangerous (and illegal) the driving act, the more severely the motorist should be punished; and the less dangerous the driving act, the less severely the violator should be punished. But prior to the development of this new system, this matter of the *degree* of threat to public safety caused by a particular violation under particular conditions was largely left up to the varying judgment of individual officers. There was little positive direction from superiors as to what was *slightly* dangerous, what was *very* dangerous and what was *extremely* dangerous. Furthermore, the directions given to officers on when to take action and what action to take were verbal directions and necessarily subject to different interpretations.

From the very beginning of the development work on the system,

police administrators agreed that in order to pool their judgment on relative degrees of seriousness, some measuring device must be used. It was decided, therefore, to fix unit values that could be scored to evaluate violations uniformly. Thus the least serious illegal maneuver was given a unit value of one. The next most serious maneuver was given a unit value of two, and the most serious maneuver was given a unit value of three.

Conditions also were weighted. "Slippery pavement," "darkness," or "heavy traffic" were each given a unit value of one, because a violation committed in any of these circumstances was obviously more dangerous than the same violation committed when none of these situations was present. If the illegal maneuver "caused person to dodge" or "just missed object" this was considered good evidence that the violation was still more dangerous. Each of these situations was therefore given a unit value of two. If the illegal maneuver resulted in the violator's vehicle to "actually hit object,"—scrape fenders, bump bumpers, or hit the coat of a pedestrian, for example—this was considered proof that the maneuver was extremely dangerous, and the situation was assigned a unit value of three.

These unit values thus provided a simple scale of from 1 to 3 units on a single violation and from 1 to 3 units on a single condition or situation. If all conditions were present, a total of 6 units could be charged. Thus, a single violation could range from one unit, without conditions, to nine units with conditions. This scale is strictly a matter of the considered judgment of many administrators each of whom was willing to give way a little on some point for the sake of producing a scale that would be acceptable to the others. Any such scale is better than no scale at all, and after several years of experience, the scale may be adjusted.

Having established the unit values, it became possible to do things that previously were difficult, impractical, or impossible. Police administrators could use the scale to:

1. Establish for the officer the minimum case on which he should take no official action. (An example of this situation would be a single violation checked in the first column on the left of the ticket but with *NO* "conditions" present.)

2. Establish the "warning level" at which a warning for a first

offense would be given. This level was originally set at two units but later raised to three units because with darkness or heavy traffic adding one unit it did not produce a reasonable proportion of warning cases. The most serious maneuvers, those in the far right column, each valued at three units, were set aside as exceptions to this warning level and all such cases result in a fine.

3. Establish the "reckless driving" charge level at any total of 6 units or more (when heavy traffic is present) either in a single most dangerous maneuver with three condition units charged or two simultaneous most serious maneuvers in the third column. This listing of the elements of reckless driving made such charges much more consistent and eliminated many which had been improperly charged.

The Committee feels that it may be possible in later years to work out a simple administrative system for using these unit values for establishing the amount of the fines indicated on the printed fine schedules of violations bureaus and perhaps ultimately for driver license suspensions. The Michigan Association of Municipal Judges has agreed to appoint a committee to study the operation of violation bureaus.

The Convertible Written Warning System

The Committee has been aware of the difficulties that verbal warnings have caused in the past. Some officers have substituted them for court action, leading the violator to believe that he talked the officer out of a ticket for instance. On the other hand, it was believed that a written warning with teeth in it when used only on first-offense minor violations, represented an excellent method of increasing officer-violator contacts without decreasing the number of cases that result in fines, consequently increasing safety education without reducing the enforcement index.

The new system makes this possible for the following reasons:

First: Every violator has to make a trip to the violations bureau whether he is to be warned or fined.

Second: The violator who has committed a minor violation has

to wait while his record is searched to see if he has any moving violation charged against him in the last 12 months.

Third: The rating scale controls the level of seriousness of an offense that can result in a warning if it is a first offense.

Fourth: The officer, if questioned by the violator, can answer truthfully that he does not know whether the relatively minor violation will result in a fine because he does not know whether or not there is a prior record against the man in the file.

The procedure is extremely simple. If the violator is stopped at all, he must make a trip to the violations bureau. The clerk of the court looks at his ticket. If the violation maneuver is in the third column (three units), or if the total score is over three units, he informs the violator that he must pay a fine in accordance with the printed fine schedule displayed for everyone to see. If the violation maneuver is in the first or second column and the total score is not over three units he pays no fine unless it is a second offense.

To determine this, the clerk checks the man's file. If there is a prior moving violation offense against the man in the last twelve months, the clerk informs the violator that he must pay the printed fine for the offense he has just committed. If there is no prior record, the clerk advises the violator of this fact and tells him that his ticket serves as a written warning, a copy of which goes in his file, and that a second ticket in the next twelve months, no matter how minor, will result in a fine.

Under this system warnings have the following advantages:

First: They make it possible for the officers to take action against cases involving lesser degrees of violation and not have the department be accused of "persecution."

Second: They focus attention on "repeaters" which produces good public relations.

Third: By being "fairer" to the good citizen who occasionally and unintentionally violates the law slightly, it permits the department to be more firm with serious violators.

Fourth: Warnings on a departmental policy basis will result in individual officers being more willing to stop motorists for less and less serious cases from which the prospect of a fine for the violator

naturally discourages them. This gives the officer a newer concept as to the prevention aspect of policing in comparison with strictly punitive action.

Fifth: It may ultimately make it possible to increase several fold the total number of officer-violator contacts thus doing a better safety educational job without making more motorists than necessary pay fines and thereby produce an unfavorable public reaction.

The ten months record of the five pilot cities show that this warning system has not resulted in substituting warnings for cases for which fines should have been paid, because the cases resulting in fines actually increased and the total number of officer-violator contacts increased considerably.

Administration

The new system does not require any new laws or ordinances. It can be fitted into almost any existing system. It does not require that there be a traffic violations bureau. If no such bureau exists, the regular judge by previous agreement can handle the warning cases in exactly the same manner as the clerk of a violations bureau would.

If a justice of the peace does not wish to maintain a name file which is needed to screen out warning cases, then the police department can maintain the name file and hold back the warning cases and send over to the justice of the peace only the non-warning cases that should result in a fine.

If a smaller department needs only an original and one carbon copy of the ticket, this can be done and does not affect the system. If a larger department wants an original and 3 carbons, the fourth copy of the ticket for the city auditor, then this can be done without affecting the system.

If the local police policy is to give moving violation two weeks to the next court day instead of forty-eight hours, this change can be made in the ticket without affecting the system.

A name file must be operated to pick out the repeaters. In cases of violation of speed regulations, officers should enter the exact speed on the ticket, as well as check the box, if the speed is over ten miles above the legal speed limit. If different speed limits exist, the limit must also be entered on the ticket. The system offers a better meas-

ure of the quality of officer stops through keeping track of each officer's tickets than is possible without such a system.

Officers should appreciate the fact that this plan represents the pooling of the best administrative thinking of over fifty police administrators. Since individual officers work under the supervision of police administration, they should be able to accept this administrative judgment as normal administrative supervision. It is not a matter of reducing in any way the exercise of the judgment of the individual officer—which quite obviously should be continually increased for the good of the department. Rather it is a matter of pooling administrative judgment so that the individual police officer may be given positive direction and have a more effective chance of his best judgment producing better results.

No matter how good the judgment of officers may be, or for that matter, no matter how much it can be improved, collectively these individual different judgments cannot operate to maximum effect unless they can be made to operate within the policy of the department. This policy must be reduced to a printed statement giving positive directions to individual officers.

Results of the System

The informed professional opinion of the chiefs and judges has been consistently good regarding the system. They feel sure that the new system is doing a more effective job than methods previously used. They feel that the following advantages have resulted:

1. The public has liked the system because they feel it is fair and takes the "guess work" out of police traffic control. This has produced public support which has been invaluable to the department during difficult days when the department had to fight for time to get a wave of petty thievery or other crimes under control.

2. It places the individual officer in a better position because the public has a better idea of what he is going to do. This takes him out from behind the mental billboard just the way police chiefs in recent years have taken their officers out from behind physical billboards.

3. There is far less difference in how individual officers handle cases. Thus a gain in uniformity has definitely been made.

4. The judges feel they are receiving more information that is accurate and that the charges are correct.

This Michigan development represents another landmark in the advancement of police administration.

In the past, uniform traffic *law* has failed completely to produce uniformity of *action,* and there were as many different policies as there were chiefs of police and individual officers. This made the uniform wording of traffic law look peculiar when it could honestly be said that in practice there was not one state that had uniform traffic *regulation.*

Michigan police administrators deserve considerable credit for their pioneering courage in developing this uniform enforcement policy.

It has been difficult, as their two years of work testify. But their efforts have been successful. They have demonstrated what a state association of chiefs of police can do.

They have produced a new system that is practical, workable, and resultful. The method and the system are what is important. Present detailed elements are relatively less important. They work well, but one year's practical application of the plan is hardly enough to guarantee that the details are perfect.

It should be perfectly obvious that wherever and whenever the police of any area can agree to use one consistent system, they will do a better job and the public will receive better treatment. The result will be better public relations for the police and fewer accidents.

It is natural that police administrators throughout the country may prefer a different Big Six violations list and perhaps a different application of the unit values. There is no reason for not selecting a different Six if the list represents 80 per cent of the local traffic problem, and if the scale of unit values screens out a fair proportion of warning cases. The committee agreed that even if there were slight variations in different cities for major violation causes, that difference would not justify the use of a different "Big Six." What is of major significance is the agreement among administrators to use a *uniform system in an area.*

Within six months the nineteen largest non-metropolitan area cities will be using a uniform enforcement policy and eighteen more

may also be in operation. This marks a good beginning toward achieving the true uniformity which the motoring public deserves. In the long run, such uniformity *must* be achieved if the public is to give police departments maximum support for accident-prevention programs.

Interior Block Parking

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This article is condensed for the Traffic Quarterly from "An Economic Study of Interior Block Parking Facilities" published by the Bureau of Highway Traffic, Yale University and the Eno Foundation.

IT IS not the purpose of this article to prove that insufficient parking space exists in the central districts of most American cities. Countless surveys have established that fact, and the condition presents itself every time a citizen drives to such a district.

This paper will point out a method by which land can be obtained for parking facilities with minimum interference to the taxpaying area. It is the central districts of our cities that pay a large part of the property tax.

In New Haven, Connecticut, selected for study, the central business district pays 20 per cent of the total city property tax on only 1 and ½ per cent of the taxpaying area of the city.[1] Since the purpose of providing parking facilities is to make the central district readily accessible by automobile, thereby increasing the value of the district, the sacrifice of taxpaying areas in order to provide such parking facilities will create a detrimental rather than a beneficial effect.

Walter W. Pollack and Karl W. H. Scholtz, in "The Science and Practice of Urban Land Valuation," wrote:

"... In the final analysis it is location, made accessible by means of communication which constitutes the chief external factor of value of city land ... Unless urban land is so situated as to make it accessible, it will be relatively unimportant for community uses."[2]

That quotation, from a book concerned exclusively with the science of evaluating land, seems to bear definitely on the traffic problem in urban areas. For the highway makes urban land areas accessible, and accessibility enhances the value of urban land.

[1] Tomorrow is Here, City Plan Commission, New Haven, Connecticut, 1944, page 14.
[2] Walter W. Pollock and Karl W. H. Scholtz, The Science and Practice of Urban Land Valuation, Philadelphia: The Manufacturer's Appraisal Company, 1926, page 4.

Interior-Block and Street-Front Property

Based on this reasoning, there should be a direct relationship between the accessibility of the individual land parcels to the street system and the comparative values of the various land parcels. If the previous quotation is sound, urban property fronting on major streets should have a much higher unit value than property situated in the rear of business establishments, accessible only by alleyways.

It was decided, therefore, to conduct a comparative study of the values of street-front properties and interior-block properties within numerous city blocks in and adjacent to the central business district of New Haven. Since the purpose of the study is to determine from an economic standpoint the desirability of acquiring various parcels of land for parking facilities, it is necessary to consider the total improved value of the land parcel and all structures on it. This total of land value and building value will hereinafter be referred to as "improved" value.

Access was obtained to the tax assessor's vault in New Haven and the total values of both land and buildings were obtained for all land parcels of fifteen separate city blocks. These blocks varied in location from 350 to 2000 feet from the center of the city. Of the fifteen areas studied, twelve are within 1,000 feet of the center of the city, which has been defined as an area extending approximately one-half block or 200 feet in each direction from the intersection of Church and Chapel Streets. This intersection is the "heart" of the central business district of New Haven. It is the main transfer point of buses and street cars radiating from the central business district to outlying areas.

The 1,000-foot distance has been suggested by various authors as the maximum distance a parker will willingly walk from his parking place to his destination. A study made in Savannah, Georgia[1] shows that 88.2 per cent of all parkers interviewed parked less than this 1,000 foot distance from their respective destinations. The de-

[1] S. T. Hitchcock and T. E. Willier, Determining Parking Requirements by Study of Parking Habits. Proceedings of the Twenty-Fourth Annual Meeting, Highway Research Board (National Research Council), 1944, page 260.

tailed location of these twelve areas in New Haven are shown in Figure 1.

INTERIOR-BLOCK AREAS STUDIED WITHIN WALKING DISTANCE
OF THE CENTER OF THE CITY

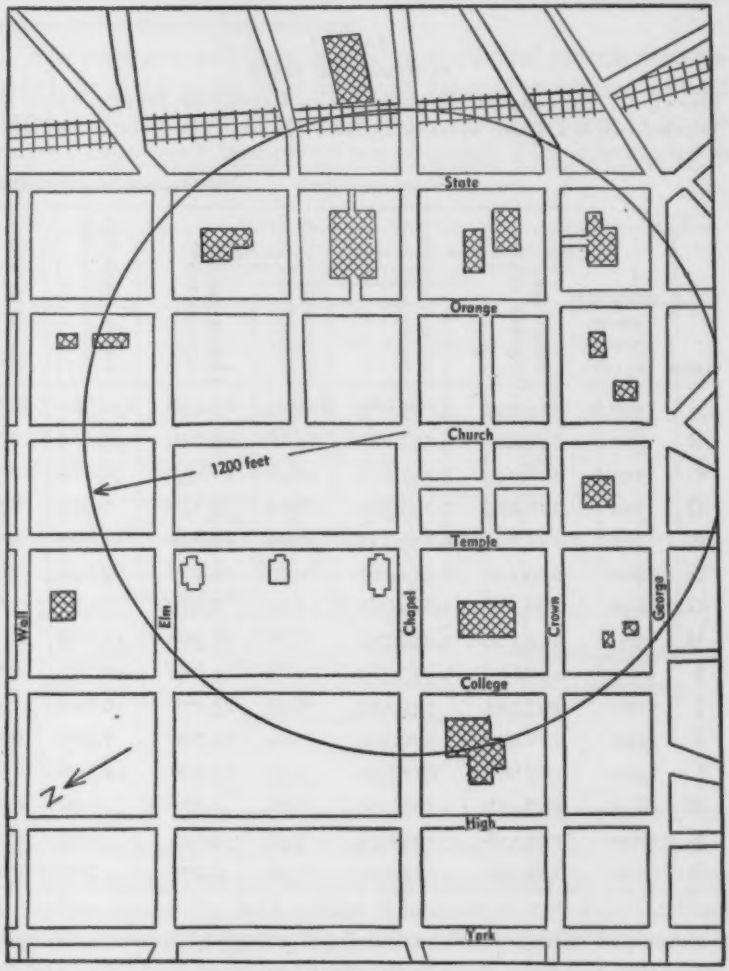

FIGURE 1

The areas were selected for study because each of the blocks contained separate "interior-block" land parcels. This terminology has been used to denote land parcels entirely surrounded by others; that is, land parcels which do not have direct frontage on any of the four streets surrounding the block.

TABLE I

SUMMARY OF DATA

SHOWING COMPARATIVE IMPROVED LAND VALUES OF STREET-FRONT AND INTERIOR-BLOCK LAND WITHIN 15 NEW HAVEN CITY BLOCKS EXAMINED

		STREET-FRONT PROPERTY			INTERIOR-BLOCK PROPERTY		
BLOCK	DISTANCE FROM CENTER OF CITY	TOTAL AREA (SQUARE FEET)	TOTAL IMPROVED VALUE (DOLLARS)	IMPROVED VALUE PER SQUARE FOOT	TOTAL AREA (SQUARE FEET)	TOTAL IMPROVED VALUE (DOLLARS)	IMPROVED VALUE PER SQUARE FOOT
A	350 ft.	124,397	3,069,065	$24.67	21,030	130,720	$6.21
B	400	179,976	4,257,480	23.66	13,849	35,415	2.56
C	450	168,349	3,191,610	18.96	21,032	38,080	1.71
D	500	118,989	2,147,565	18.05	3,150	8,375	2.66
E	550	134,301	2,153,745	16.04	12,846	39,500	3.07
F	800	179,352	2,311,105	12.87	16,208	64,040	3.95
G	850	160,112	1,809,750	11.30	3,545	5,975	1.68
H	900	152,258	1,351,725	8.88	11,400	12,860	1.13
I	1000	200,604	2,333,785	11.63	4,620	12,775	2.76
J	1100	107,523	741,125	6.90	13,278	16,820	1.27
K	1200	121,329	370,400	3.05	25,700	7,500	0.29
L	1500	183,809	612,850	3.33	13,500	22,300	1.65
M	1600	145,435	336,515	2.31	1,300	130	0.10
N	1800	72,536	179,045	2.47	3,045	525	0.17
O	2000	136,440	322,210	2.36	5,500	700	0.13

Assessed values of the various land parcels showed that assessed valuations had been given to various street-front land parcels on the basis of the number of front feet the land parcel occupied along the

street. In the case of interior-block land parcels, no such measure had been used, but a record was kept of the total area in square feet of the land parcel and the total assessed valuation. No direct comparison, therefore, could be made between these two different measures of value. It was necessary to adjust the values of the two types of land parcels to a common denominator.

The total area and improved value of all land parcels were obtained. By dividing the total improved value of an individual land parcel by its total area in square feet, the total improved value per square foot for each land parcel was obtained. This information is summarized in Table I.

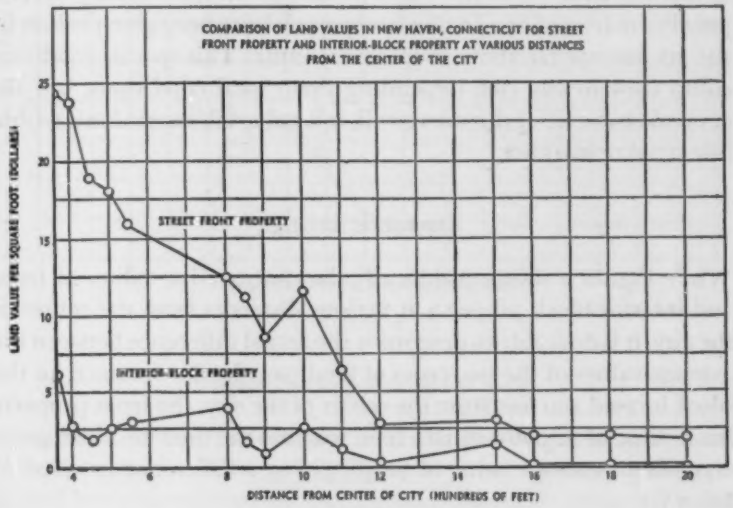
COMPARISON OF LAND VALUES IN NEW HAVEN, CONNECTICUT FOR STREET FRONT PROPERTY AND INTERIOR-BLOCK PROPERTY AT VARIOUS DISTANCES FROM THE CENTER OF THE CITY
LAND VALUE PER SQUARE FOOT (DOLLARS)
STREET FRONT PROPERTY
INTERIOR-BLOCK PROPERTY
DISTANCE FROM CENTER OF CITY (HUNDREDS OF FEET)

FIGURE 2

Averages of value per square foot for both front property and interior-block property were obtained for each city block studied.

These values were plotted in graph form and are shown in Figure 2. In this figure, the land values of both front and interior block property are plotted against the distance of the block from the center of the city.

It can be seen in Figure 2 that the highest land values for both

front and interior-block property were found in the blocks nearer to the center of the city. As the distance from the center of the city increases, the curve representing the land value of front property decreases rapidly. The curve representing interior-block land values decreases also as the distance from the center increases. But this decrease is not as rapid, nor is it as constant as the curve representing front property values.

There are irregularities in the curves. An abnormally high value of both front and interior-block property, for example, was found at a distance of 1000 feet from the center of the city. This is explained by the fact that this particular block contains many parcels of tax-free land. Since the assessed value given these land parcels is purely a matter of record, the land parcels have been given values by the tax assessor far above their actual value. This special condition could exist in any city, depending upon local conditions, but the general character of this curve will, it is believed, repeat itself within any given urban area.

Economic Savings

While Figure 2 shows graphically the comparative values of front and interior-block property at various distances from the center of the city, it is desirable to determine the actual difference between the average values of the two types of land parcels. For instance, in the block located 400 feet from the center of the city, the front property has a value of $23.66 a square foot, whereas the interior-block property has an average value of $2.56, giving a difference in value of $21.10.

This difference has been computed for each of the blocks studied and has been classified as the "Savings" which would result from the use of interior-block property for parking in lieu of front property at various distances from the center of the city. The above information is shown graphically in Figure 3.

The curve represents the savings per square foot from the use of interior-block land, and includes only the initial cost of acquisition of land and existing appurtenances. Since most front properties are heavily developed and interior-block properties contain gen-

erally run-down or temporary buildings, there would undoubtedly be other costs involved in the acquisition of front properties for parking facilities. These additional costs would create an even greater saving in favor of the use of interior-block land for parking locations.

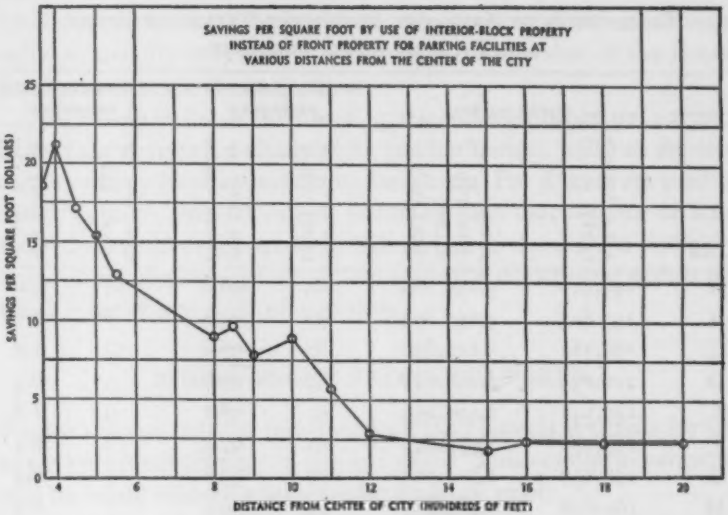

FIGURE 3

Comparative Value to the City

Another factor in the selection of land for off-street parking facilities is the comparative value to the city, in its present form, of each type of land being considered for use. Table II shows this information for the fifteen city blocks considered in this study. Land areas in square feet and assessed values in dollars were totaled for each parcel of front property and each parcel of interior property. Areas and values for *each* land classification were then divided by the areas and values for *all* land within each block. This determined the percentage of block area that each type of land occupied and the percentage of value that each type contributed to the total block.

Comparisons of value between different blocks bear no significance, for the blocks are of different dimensions, and the ratio of

front property to interior-block property is different for each block. It is significant, however, to compare the figures individually for each block.

TABLE II

COMPARISON OF AREA AND ASSESSMENT VALUES OF FRONT AND INTERIOR-BLOCK PROPERTY

	TOTAL BLOCK		STREET-FRONT PROPERTY		INTERIOR-BLOCK PROPERTY	
BLOCK	AREA (SQUARE FEET)	TOTAL IMPROVED VALUE (DOLLARS)	PER CENT OF BLOCK AREA	PER CENT OF BLOCK VALUE	PER CENT OF BLOCK AREA	PER CENT OF BLOCK VALUE
A	145,527	3,199,785	85	96.0	15	4.0
B	193,825	4,292,895	92	99.1	8	0.9
C	189,381	3,229,690	83	98.8	17	1.2
D	122,139	2,155,940	97	99.6	3	0.4
E	147,147	2,193,245	91	98.2	9	1.8
F	195,760	2,375,145	91	97.3	9	2.7
G	163,657	1,815,725	97	99.6	3	0.4
H	163,658	1,364,585	93	99.5	7	0.5
I	205,224	2,346,560	97	99.4	3	0.6
J	120,801	757,945	89	97.7	11	2.3
K	147,029	377,900	82	98.0	18	2.0
L	197,309	635,150	93	96.5	7	3.5
M	146,735	336,645	99	99.96	1	0.04
N	75,581	179,570	95	99.7	5	0.3
O	141,940	322,910	96	99.7	4	0.3

The percentage of total block area devoted to interior-block property varies from a low of 1 per cent to a high value of 17 per cent.

As can be seen by examining Block L in Table II, this block has 7 per cent of its total block area devoted to interior-block property, but the block derives only 3.5 per cent of its total value from this interior property. This is a ratio of *value* to *area* of 1 to 2. Block M, showing only 1 per cent of its area devoted to interior-block property, shows

this same property contributing the small amount of 0.04 per cent of the total block assessed value. This gives a 1–to–25 ratio of value to area for the interior property of Block M.

By obtaining averages for all blocks studied, an average ratio of unit-value to unit-area for interior-block property studied is 1 to 6. This means that the interior-block properties studied have a unit-value to the city *only one-sixth* that of the unit-value of the street-front properties in the same areas.

This indicates that the use of interior-block properties, particularly if they are to be obtained by condemnation, will not deprive the city of any great amount from land taxes. For if taxes are paid in direct ratio to assessed values, it can be said that a piece of land located on street-front property will return to the city six times the amount in taxes that a piece of land of similar dimensions within the block interior is capable of returning.

STREET-FRONT VALUES COMPARED

Figure 1 shows that the interior-block land parcels available for use as parking facilities vary in size and shape. This condition probably will be found wherever separate land parcels exist.

Since there is a definite decrease in value for separate *interior* parcels of land, it seems likely that a comparative value exists between various portions of any *frontage* land parcel. If the same relationship exists between various sections of front property that exists between front property as a unit and interior property, then it would appear that the value of each foot of a front-land parcel would decrease from the value of the preceding foot as the depth of the land parcel *increases*.

The Somers Depth Curve

Such a relationship was established some time ago in the construction of the Somers Depth Curve, shown in Figure 4.[4]

Such a depth curve establishes a mathematical relationship between any two parts of sites affected by a single street influence. It

[4] Pollock and Scholz, op. cit., page 351.

also makes possible the systematic treatment of varying depths for purposes of valuation.

Years ago, Mr. Somers began investigating the relative depth values of regular land parcels that had varying depths. He made this

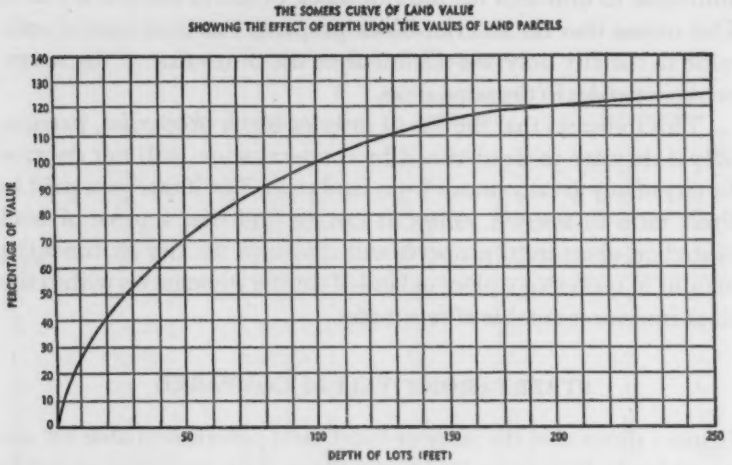

FIGURE 4

study in St. Paul, Minnesota, where the business section was laid out in a series of blocks, 300 feet square. These blocks were divided into a series of inside lots, each with 50-foot frontage and 100 feet of depth. After a careful study of hundreds of lots in actual use, and of hundreds of transfers of lots of different dimensions, a tentative scale of values was adopted.

Approximately 70 per cent of the value of a 100-foot depth was found to have been absorbed by the 50 feet nearest the street front, leaving 30 per cent of the total value to the rear 50 feet. A 15 per cent increase in value over the 100-foot depth was assigned to the third 50 feet in a lot of 150-foot depth. These percentages were represented graphically. A curved line was drawn from the zero point, representing the street line, through a 50-foot point, representing a lot 50 feet deep, at an elevation to indicate 70 per cent, thence through a 100-foot point at an elevation indicating 100 per cent, and finally to a 150-foot point at elevation of 115 per cent.

Figure 5 shows the portion of the original Somers Depth Curve extending to a depth of 250 feet. From this curve have been obtained the values shown for two-foot intervals from the street-front to a

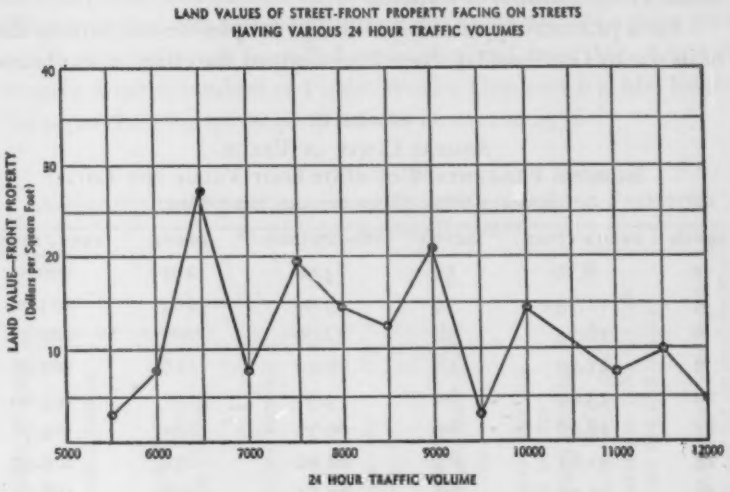

FIGURE 5

depth of 150 feet in Table III. These values apply to lots having a single street influence, and cannot be used for evaluating portions of land parcels located on the corners of intersecting streets.

To obtain the value of any two feet, subtract from the valuation allocated to that number of feet the relative value of the immediately preceding number of feet in the table. The difference will indicate the relative value to be allocated to any specific two-foot section. Such a computation will show that each square foot following the one fronting on the street has a lower valuation than the preceding square foot.

Application of the Depth Curve

It seems proper, then, to use this Somers Curve to determine the value of rear portions of front property when additional space is desired for interior-block parking facilities. In the majority of areas examined for the present study, the rear portions of front-street land

parcels were inefficiently used. If these rear sections can be obtained at a reasonable price—and this seems likely from the Somers System—the interior-block land parcels can be expanded to sufficient size to house a large number of vehicles.

For a practical application of this principle, we can turn to data of its use by Garden City, New York—one of the cities, it was found,

TABLE III

SOMERS CURVE OF VALUE
SHOWING PER-CENTAGE OF UNIT-FOOT VALUE FOR LOTS
FROM 2 FEET DEEP TO 150 FEET DEEP

DEPTH	PER-CENTAGE	DEPTH	PER-CENTAGE	DEPTH	PER-CENTAGE
2	6.10	52	74.00	102	100.85
4	11.75	54	75.50	104	101.70
6	16.75	56	76.90	106	102.48
8	21.20	58	78.20	108	103.25
10	25.00	60	79.50	110	104.00
12	28.36	62	80.77	112	104.72
14	31.61	64	82.00	114	105.43
16	34.92	66	83.21	116	106.13
18	37.97	68	84.42	118	106.81
20	41.00	70	85.60	120	107.50
22	43.96	72	86.70	122	108.11
24	46.61	74	87.78	124	108.75
26	49.17	76	88.82	126	109.35
28	51.61	78	89.87	128	109.93
30	54.00	80	90.90	130	110.50
32	56.10	82	91.89	132	111.02
34	58.20	84	92.86	134	111.55
36	60.30	86	93.80	136	112.05
38	62.20	88	94.73	138	112.52
40	64.00	90	95.60	140	113.00
42	65.90	92	96.50	142	113.43
44	67.60	94	97.40	144	113.85
46	69.30	96	98.30	146	114.25
48	70.90	98	99.17	148	114.64
50	72.50	100	100.00	150	115.00

in which this principle is applied. In 1936, a definite parking plan was adopted for Garden City's business section.[8] Land for parking facilities was obtained by condemnation. To fix a relative valuation for rear portions of street-front property, the Somers system was used. Fifteen typical examples are shown in Table IV. The data from which this table was compiled were obtained from Mr. Allan H. Rogers, Superintendent of Public Works, Garden City. Mr. Rogers has supervised the entire project from its start in 1936.

TABLE IV

ASSESSMENT OF REAR LAND FOR OFF-STREET PARKING FACILITIES BY USE OF SOMERS SYSTEM

PARCEL NUMBER	AREA IN SQUARE FEET		ASSESSED VALUATION			TOTAL SAVINGS BY USE OF SOMERS SYSTEM	NO. OF CAR SPACES ACQUIRED (180 SQUARE FEET PER CAR SPACE)	SAVINGS PER CAR SPACE BY USE OF SOMERS SYSTEM
				REAR AREA				
	ENTIRE PARCEL	REAR AREA TO BE USED FOR PARKING	ENTIRE PARCEL	PRORATED BY AREA	PRORATED BY SOMERS SYSTEM			
1	43,250	3,000	$82,700	5,739	800	$4,939	17	$290.50
2	4,500	1,200	5,520	1,472	528	944	6	157.33
3	20,000	5,000	22,300	5,575	1,280	4,295	28	153.40
4	7,500	2,000	9,200	2,453	880	1,573	11	143.90
5	23,200	12,200	20,000	10,517	3,306	7,211	67	107.61
6	13,920	4,500	12,000	3,879	1,582	2,297	25	91.88
7	20,000	8,000	22,300	8,920	5,483	3,447	44	78.11
8	17,635	4,532	15,000	3,855	2,129	1,726	25	65.04
9	20,000	5,000	4,375	1,093	251	842	28	30.07
10	20,000	5,000	4,375	1,093	251	842	28	30.07
11	25,000	10,000	4,550	1,820	399	1,421	55	25.83
12	25,000	10,000	4,550	1,820	399	1,421	55	25.83
13	25,000	10,000	4,550	1,820	399	1,421	55	25.83
14	25,000	10,000	4,550	1,820	399	1,421	55	25.83
15	25,000	10,000	3,950	1,580	346	1,234	55	22.43

[8] Allan H. Rogers, A New Solution to the Parking Problem (Public Works Magazine), July 1938, page 20.

A comparison of the valuation of rear land prorated according to area with the cost, as it was actually prorated by the Somers system shows a tremendous saving in the initial cost of land acquisition. Based on 180 square feet per car space, savings range from $22.43 to $290.50 per car space.

ENTRANCES AND EXITS

If interior-block property is to be used for parking with minimum disturbance to street-front business, the entrances and exits must be located carefully. The high square-foot value of front property may make an access through such property a large item in any budget for interior-block facilities.

In a majority of instances, public alleyways may exist. These may be converted into parking entrances and exits. In other cases, as in New Haven, the master plan of the City Plan Commission may have as its very basis the closing of certain streets to create larger blocks. Closed street areas can usually be obtained for parking access.

Land Values Related to Vehicular Volume

Cases may develop, however, in which no alleyways or other entrances are available. In order to obtain for this study a comparison between the value of front property and of traffic on the street it borders, the October 1945 traffic volumes for the streets surrounding the blocks under consideration were examined. This information, provided by the Connecticut State Highway Department, was plotted against the square foot value of the front property for each street. In cases where land values were known for both sides of the street on which volume was given, average values were used. Averages were also used when two or more streets carried the same volume. Results are shown in Figure 5.

As traffic volumes increase, land values tend to decrease. The trend is gradual but clear. A study involving more complete data probably would reveal the same characteristics.

It appears sound then, both from the economic and the traffic standpoints to locate the entrance of an interior-block parking fa-

cility on the street carrying the heaviest traffic flow. As a general rule, such treatment will make the parking facility more accessible to the greatest number of potential users.

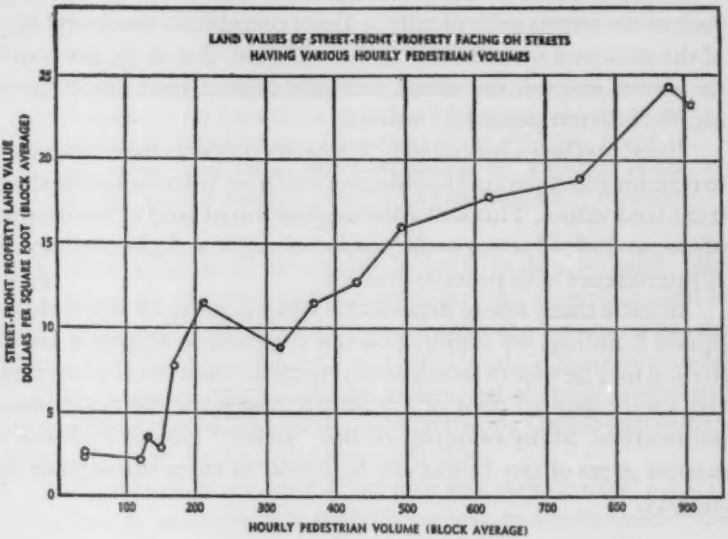

FIGURE 6

Land Value Related to Pedestrian Volume

The interference that entrance location may cause pedestrians should be considered, however. To determine the relationship between the land value of street-front property and the pedestrian volume on the adjacent street, short counts of pedestrian volumes were made for all streets surrounding the fifteen city blocks being studied. Fifteen-minute counts were made on each of the four streets surrounding each block and the four counts totaled for hourly volume. This is herein known as the "block average." To correlate closely the counts between blocks, all counts were made on week days, Monday through Friday, during fair weather, and between 2 P.M. and 4 P.M. Block averages were then plotted against the average street-front property value. Results appear in Figure 6.

Pedestrian volumes were lowest for blocks having the lowest street-front land values and the pedestrian volume increased directly with an increase in land value.

When pedestrian volumes were compared with land values for each of the streets individually, a direct correlation was found in 39 of the 60 streets involved. It can be said then, that in 65 per cent of the streets studied, the streets with the highest land value carried also the heaviest pedestrian volume.

Based on these observations, it appears sound to locate entrances to interior-block parking facilities on the street with the lowest street-front land values. This will allow acquisition of land at a minimum of cost, and afford access to the maximum traffic and give a minimum of interference with pedestrian travel.

In some cases, where demand for space is great, or where multi-storied buildings are standing on the areas where entrances are desired, it may be wise to secure access rights through street-front property on the ground floor of a building, and leave the upper floors undisturbed. Many examples of this "arcade" type of entrance to interior areas of city blocks can be found in cities throughout the country.

The Place of Land-Use Control in Traffic Control

HENRY S. CHURCHILL

Mr. Churchill, of Churchill-Fulmer Associates, New York, is Vice-Chairman of the Committee on Urban Planning of the American Institute of Architects and Consultant to the Planning Board of Jersey City, New Jersey. He is the author of "The City Is the People." He is a member of the American Institute of Planners.

HIGHLY specialized professionals, such as lumberjacks, often fail to see the woods for the trees they are chopping. And because traffic engineers are so concerned with the flow of traffic, they often are inclined to neglect the city-wide implication of their work.

This is not surprising, for the techniques of traffic engineering are complicated and absorbing, and a well-done Origin and Destination study seems worth while for its own sake.

Nevertheless, it is a good thing now and then to stand back and take a look at the city and its traffic as a whole, and to remember that, after all, transportation is merely a means to an end. That end is getting people and goods from one place to another.

So it might seem right to ask, why do people want to get from one place to another, and what are they going to do when they get there? And the second thing is to ask, if *things* were arranged better, would people have to move around so much? Or put another way, is not the "traffic problem" a problem of disorderly cities, perhaps, instead?

SEPARATING THE INTERTWINED

Cities have grown according to their traffic facilities, and these in turn have been located either by geographic circumstance or by the practicability of current techniques of transportation; or, usually, both. The great mass-movers of goods and people are what have shaped our industrial cities: ships and railroads. These have required terminal facilities—docks and yards, repair and storage. From these

terminals—and the local freight station is a terminal for goods consigned to it—radiate the distributing transport-wagons, trucks, streetcars, the automobile and auto-truck. The primary pattern of the town was determined by the relation of port to rail or competing rail to rail, and the consequent location of industry in relation to them.

City streets therefore serve as distributors and collectors of "retail" shipments for the "wholesale" movers. They also serve as distributors of intra-city traffic of all kinds, including pedestrian traffic. To these respected "normal" functions have been added two others: service as through-streets for traffic that doesn't give a damn about the city it has to struggle through, and service as storage yards for the cars of workers, shoppers, and amusement seekers.

The real problem would seem to be separating these disparate functions that are now intertwined. And this would seem to be an impossibility, no matter how many O and D studies are made, as long as the origins and destinations are in the wrong place.

Long-Range Planning

This is a city-planning problem, of which traffic is only a part. Any lasting answer must come not merely from traffic-control, but from land-use control. The only way that traffic flow can be controlled is by controlling its origin and destination, which broadly means the use of land: the kind of buildings at each end and along the way, the number of people in those buildings, and what they are used for. Highways can then be planned for specific uses, parking and other terminal uses can be allowed for, and land values will be stabilized.

This type of approach has been used in a limited way in designing new towns, such as the Greenbelts and some of the war-industry towns; also a few subdivisions have been thus rationally laid out. Not only have streets been laid out for specific loads, but also sewers and other public utilities have likewise been planned for a predetermined population instead of either for an uneconomical maximum or an unrealistic minimum.

Theoretically, this is a function of zoning. But zoning alone, in an existing or expanding town is an inadequate instrument. What

is needed is appropriate zoning along all new traffic-ways, so that the goal of land-use related to traffic will come about gradually. This should call for the closest cooperation between traffic-engineers, city-planners and city governments.

Design for Living

The need to separate various kinds of traffic so as to expedite the circulation of people and goods will force the abandonment of some well-established habits and beliefs. One of these notions is that there must be constant direct vehicular access to all the stores in a main shopping center. That this access is not necessary is already clear in the small centers, and in the attempts to provide peripheral parking and bus shuttles. The obvious next step is to prohibit vehicular traffic in the retail center (or a large part of it) altogether, except of course for deliveries, which might be limited to certain hours.

The new centers of the future will surely be designed along those lines; the one planned for north of Boston sets the pattern clearly: ample room to park; once parked, no traffic, no confusion, *everything* at hand—including baby-parking—in pleasant and well-ordered surroundings.

"Everything" is meant literally. This is no "neighborhood" center—it is a metropolitan retail district carefully transplanted to an area where it can do business by taking it away from the central city. Shopping done, the lady drives her car to a package-collection station to which everything has been sent from wherever bought. It is put into her car and off she goes. Why, for heavens sake, go to Boston?

These are the things that are going to remake cities and traffic patterns. Couple the self-contained shopping-center idea with industrial plants of the magnitude of Willow Run or Dodge-Chicago and you see emerging an entirely different set of traffic needs from what any present O and D "trend" would show.

RE-CENTRALIZATION

It also seems logical that more emphasis will be put on providing properly for truck traffic. So far most highways and all parkways have

been planned for the benefit of the non-productive passenger car. Where passenger and truck traffic have been separated, the favored route has always been assigned to the passenger car. In heavy industrial areas—whether *in* cities or *between* cities—this discrimination is working havoc. Truck movement is slowed down intolerably; on mixed routes both passenger and trucks are dangerously discommoded.

In industrial areas certain streets and certain roads (or lanes in highways) should be assigned to trucks only and forbidden to passenger cars, except perhaps for access to industrial plants. In such areas the passenger car is a liability, just as in residential areas the truck is a liability.

As the industrial and residential portions of cities recentralize in increasingly even distribution throughout the region, trucks will become a still more important part of the economy. They will move more goods—raw materials, parts, and finished products—than ever before, since the movement will be not merely from a mass-transport terminal to a factory, but from parts factory to assembling or finishing plant and to retail and distributor outlets within the region. If industry is to function efficiently the truck must not have to battle passenger traffic all the way. And also if business is to function, office-workers and customers must be able to get to and from residential areas without being wrecked by trucks.

Congestion Comes from Obsolescence

This may sound fantastic in terms of today's truck traffic volume. What could we have saved if we had forbidden railroad grade-crossings in the first place?

I have touched upon the new patterns of cities, and I want to note it from another angle. Congestion is inherent in automobiles, skyscrapers and obsolete street patterns. The "parking problem" is the effect of the three.

It is an insoluble problem as long as our cities continue their present street patterns, and make them worse—not better—by building highways that act as feeders to the centers. It is an insoluble prob-

lem as long as we control neither the intensity to which land can be used, nor the use to which the private automobile can be put.

In short, if the problem is solved (and of course it must be), the solution will automatically change the pattern of the city, since two things cannot occupy the same space at the same time. Either the automobiles or the buildings—i.e. the intensity of land use will have to give way, and I have no doubt it will be the buildings.

Horizontal Expansion

Most of the attempted solutions of the parking problem are postulated on "preserving downtown values." This is an impossible effort, since the downtown "value" is a product of the tall building and congestion; the automobile, both in motion and when parked, requires horizontal expansion and open space.[1]

How this horizontal expansion is to be brought about in an orderly fashion with proper provision for cars and trucks is the primary problem for city planners and traffic engineers. Recentralization is being brought about by many forces; in passing one more must be mentioned—atomic power. If, as is generally predicted, the developments in this field mean great power in small units, transformation of our cities is indeed inevitable.

A Future Pattern

The economics of these processes are another matter. But that is not a matter for technicians but for bankruptcy courts and legislatures. The situation may be summarized by noting that unamortized obsolescence can only be paid for by bankruptcy, call it by whatever other name you wish. None of our municipal corporations has ever amortized its physical plant against obsolescence. The consequences of such financial ignorance are catching up with them.

The traffic engineer, then, should watch for the spread of resi-

[1] The difficulty real estate faces in this paradox is well set forth in the May, 1947 issue of Urban Land, which points out "that to apply parking requirements under zoning to individual buildings in the central business district is a dangerous proposal as it invites the destruction of the very thing it attempts to preserve."

dence, business and industry into the metropolitan region through new nuclei planned at first for only one of those three but which will inevitably attract the other two. Here is your future pattern, here is what you must think about, because this and not present "travel and parking habits" are the real indicators of trend.

If you build according to the latter, you will build obsolescence; if you are wise in your following—perhaps leading in—the former, your work may be in the groove of progress.

Responsibility of the Highway in Traffic Accidents

JAMES S. BURCH

TO WHAT extent does the highway contribute to motor vehicle accidents? That would appear to be a rather simple question, in view of the many years of accident records and analysis. The fact, however, is that this is a very complex question, as we shall soon see.

The analysis of cause in motor vehicle accidents is an involved proposition at best. "What was the major cause of the accident" is usually a $64 question. Take, for example, a simple type of accident: A car at night kills a pedestrian along the edge of the highway. The driver did not see the pedestrian, the pedestrian is dead, and there was no witness.

What was the major or proximate cause? Was the pedestrian walking? Was he sitting or sleeping on the ground? Was he blind, or deaf; drunk or doped; sleepy or normal? Did he stumble? Was he blinded by lights? Could the driver have seen him if the driver himself was partly blinded by lights from another car? Could the blame be placed on inadequate highway width, or lack of sidewalks in this strictly rural area? *What was the major cause?*

Statistics Difficult on This Point

We must also determine: Was the accident investigated? and, if so, how thoroughly, and how soon after the occurrence? If it was investigated, was it reported completely, including the exact location?

All those questions arise with the simplest accident. Many more arise where there are two or three vehicles involved, where there was a collision, drinking, a side road, poor brakes, a curve, a slow truck, a blind hilltop, etc.

For several years, we carefully studied every accident report that was submitted to the Highway Safety Division of North Carolina in an attempt to determine the extent to which highway deficiencies

contributed to accidents, and where these deficiencies were located. We found many things.

First, only a small percentage of the accidents was reported at all. Thus, a statistical analysis is questionable at the outset. With the probability of accidents occurring, during any hour of the 24, on any section of more than 10,000 miles on the rural state highway system in North Carolina, and with drivers generally trying to avoid official reports, except in case of a death, it is easy to see how impossible it is for state highway patrolmen to investigate even half the accidents; and, of course, as we know, the state highway patrol has many other duties. Based on national relationships, it is our belief that more than 78,000 motor vehicle accidents of all types occurred in North Carolina last year. Yet, the highway safety division's summary for the year was only 10,287 accidents.

Second, we found that the exact location of the accident is seldom shown on the reports we do get. "Two miles west of Winston-Salem on US—158" may seem to be exact, but is that exactly two miles or 2.15 or 2.67 miles? It makes a big difference to us because we may have highway deficiencies at some points in this general vicinity and none whatever in others. And is this two miles measured from the city limits, or from the City Hall, or from where?

"Not More Than 8 Per Cent"

So finally, in our analysis, we could use only the fatal accidents. These are always reported in some form or another, because the coroner must investigate. But, even on these, the reports are often deficient, especially as regards the exact location. So, in the analysis, we could rely on only a small percentage of the total accident information.

Taking reports that are complete, we then tried to find the cause of the accident; i.e. the major cause. Here are involved opinion, missing evidence, questions as to cause that would confound Solomon himself. An accident usually involves two or more contributory causes or situations. Here is a typical simple example:

A driver fails to negotiate a moderate curve at night, runs off the road, turns over and kills himself. When investigated, the odor of alcohol is observed about the mouth of the corpse, or on the

breath of the dying man. What is the major or primary cause? Is it liquor, sleep, excess speed, darkness and blinded by approaching car, poor steering device, forced off by another car, bad brakes, slick tires, or the curve itself?

If we find the curve may be safely negotiated at 55 m.p.h., should we find that the curve itself even contributed to the accident? I think you will readily see how complex is this matter of accident analysis. I think you will also take with a few grains of salt many of the statements you see and hear about the causes of accidents.

In analyzing some 2,359 complete and separate fatal accident reports, the best conclusion we could come to was this: Not more than 8 per cent of the fatal rural motor vehicle accidents on the North Carolina State Highway System are connected with highway deficiencies. You will note that we did *not* say the accidents were *caused* by these deficiencies; rather, we said they were *connected* with them. We also said that *not more* than 8 per cent were connected. The figure may be as low as 2 per cent, or lower. The analysis of the highway safety division last year, based on more than 10,000 accident reports in North Carolina, showed that less than 1 per cent of the accidents were reported as due to highway deficiencies, and this was based on the question in the report as answered by the investigating officer.

The National Safety Council, in 1946, pointed out that state reports indicated a highway deficiency in 7 per cent of the accidents. It does not, of course, follow that the defect necessarily *caused* the accident.[1]

Drivers and Walkers Are Blamed

In our own study, we concluded that some 60 to 70 per cent of the rural fatal accidents were due to one or more of the following five causes:

1. Driving too fast for conditions
2. Driver had been drinking

[1] Editors' note: cf report of 10-year survey, published in January, 1946 by Spencer Miller, Jr., State Highway Commissioner of New Jersey, which claims that after seven specific changes in engineering design had been made on New Jersey highways where accidents were frequent, the accident rates at those places decreased an average of 76 per cent.

3. On wrong side of road, passing, etc.
4. Reckless driving
5. Pedestrian fault.

Another way we summarized it was this: That the blame for the fatality could be placed:

65 to 75 per cent on the driver
30 – 40 per cent on the pedestrian
A few per cent on the vehicle condition
A few per cent on the highway deficiencies.

Thus, all evidence points to the conclusion that highway defects, or inadequacies as such, represent a minor cause of accidents. It is further our opinion that, if the driver would drive prudently, he could easily appraise and recognize these deficiencies, which would then disappear almost completely as contributing causes. Experience in driving on the North Carolina state highway system will bear witness to the wisdom of this statement.

Highway Faults Listed

Now, what are these deficiencies, and what do we do about them?

Let's first recall that the vast majority of our present highways were designed and built primarily for traffic in the 1920–1930 period. At that time, prevailing speeds were in the order of 35 to 45 miles an hour. Traffic volume was relatively low. The few trucks on the road had a width of only 6 feet.

On these same roads, our legislature now permits up to 55 miles an hour (July 1, 1947) for passenger cars, buses and light trucks. Present speeds average 45 miles an hour, but 24 per cent of the vehicles last month were traveling at speeds above the present absolute limit of 50 miles an hour. Traffic volumes have doubled and doubled again since 1930. All our trucks, except those of the pick-up variety, are 8 feet wide, as are all buses.

So you see, while we have continued to improve portions of the state highway system from year to year, much of our system has become obsolete because of the great changes in the traffic that uses it.

Thus, it is probable that these obsolete features of the state highway system may be contributing to accident occurrence. Surely much of the highway system is inadequate for present traffic, and for the traffic that is to come within the next few years.

Remembering that buses and the majority of the trucks are 8 feet wide, we may point out the fact that we have 209 miles of rural state highway pavement only 16 feet wide, and that all of this 209 miles carries more than 1,000 vehicles on the average day of the year. We have 1,474 miles of 18 foot road carrying more than 1,000 vehicles a day (1946). Those widths are insufficient; they force wide vehicles to the edge of the pavement, and sometimes on to the shoulders. We have several thousand miles more of 2-lane road which is inadequate for its traffic, as well as a limited mileage of 3-lane roads that are obsolete and inadequate for the traffic they are now carrying.

In connection with the planning of State Highway improvements for the construction year 1948, we have selected and have shown on a large map all those rural sections of pavement of 16 feet and narrower width which carried more than 500 vehicles a day last year. Included in these categories are some 1409 miles admittedly deficient as to width. These miles represent about 13 per cent of the length of our rural state highway system, but they carry 24 per cent of the vehicle mileage on the rural state highway system. We expect to concentrate on these sections next year in an attempt to do the utmost possible in the way of modernization.

Other Defects Held More Important

North Carolina was a pioneer in the building of a state-wide hard surfaced highway system. For this reason, as compared to the other states, we have an unusually high percentage of "vintage" roads that are obsolete and inadequate for current traffic demands. I believe, however, that these deficiencies account to only a limited extent for North Carolina's near-top position among the states in the traffic fatality frequency index.

We have many other shortcomings that seem more important. For example, at least 90 per cent of our drivers have never been ex-

amined—orally or otherwise—as to their knowledge of driving, or as to their fitness or ability to drive. We have never had a vehicle inspection law. Our enforcement has always been inadequate, and our courts have been vested with very broad discretionary powers.

Our shoulders generally are too narrow to serve as safety valves or escape areas for vehicles in distress.

Our curves generally are not dangerous at any reasonable speed, but we do still have a number that involve reduced speed. These are so marked, and should be rebuilt. In the design and construction of curves, we can accomplish much through the device of super-elevation or tilt, combined with spiralling. All our modern pavements are built according to these designs and practically all of our sharper curves on old pavements are super-elevated. It is possible to design a curve so accurately that the car will actually drive itself at the designed speed.

The Packard test track at Utica, Michigan is so carefully designed that a car can negotiate the sharp curves at 100 m.p.h. without steering action on the part of the driver. This will indicate what can be done in the way of design. Of course, we cannot go too far in this because the highways must accommodate slow vehicles, including wagons; and extreme tilt would be dangerous for them. Incidentally, and contrary to occasional remark, none of our curves are super-elevated in the wrong direction.

Limited Sight Distance Is Dangerous

Perhaps our greatest type of highway deficiency, under modern heavy traffic volumes, is the limited sight distance which occurs so frequently at hilltops in the Piedmont and foothill sections of the state. Our system is made up almost exclusively of 2-lane pavements. Since loaded trucks cannot pull any substantial grade at regular road speeds, the car driver often finds himself trailing a truck up a hill. He could probably overtake and pass the truck in safety, *if* he knew there was no other vehicle approaching within about 1,500 feet. But he cannot know this if his sight distance ahead is severely limited by the hilltop. He is tempted to take a chance and pass anyway (often with disastrous results). We have thousands of places on

the state highway system where the sight distance is too short, and where reconstruction would be justified to eliminate congestion and remove the temptation to pass.

This matter of adequate sight distance as related to volume, width, grade and design speeds is a rather involved relationship. However, sufficient research has been completed to guide us on the design, signing and special pavement markings. Modern design incorporates adequate sight distance and it is hoped that we can soon remodel the state highway system and extend the sight distance at least at the worst places under the heaviest traffic volumes. Until this can be done, the prudent driver will observe the special signs erected, the special center-line barrier markings, as well as use his own good common sense and restraint, if he is to avoid trouble at these points.

Narrow Bridges and Slick Pavement

Narrow bridges come in for their share of accidents. Most of our bridges were built when truck and bus widths were 6 feet, and when the movement of these vehicles was rather slow. Now, they are 8 feet wide. Buses are our fastest travelers. Big, heavy trucks build up their greatest speeds downhill before they get to the bridge, in order to have momentum to aid them in climbing the upgrade beyond the bridge. We have widened hundreds of narrow bridges on the main routes, but this work is quite expensive—even exhorbitant in cost just now—and must, usually, be done under traffic. Hundreds more of these bridges need widening.

The railroad grade crossing accident—once the worst man-killer of them all—has almost passed out of the accident picture on North Carolina rural state highways. The reason is that, over a period of 25 years, we have eliminated all the more important grade crossings and have put special automatic signals at practically all the others. It is possible to cross the entire state on many routes without ever crossing a railroad at grade in rural areas.

We have some small amount of trouble with slick pavements. For a pavement to be dangerously slick, several particular conditions must be met. It must be smooth, it must have accumulated a heavy oil film from passing vehicles, it must be wet by rain which is not

hard enough to wash off the film, and the vehicle tires must be smooth. Our signs "Slick When Wet" warn the prudent motorist of these sections where such danger may lurk. In fact, if the driver will follow our warning and danger type signs, he should never be adversely affected by highway deficiencies, insofar as his own driving is concerned.

One of our greatest needs to meet modern traffic demands is the redesign and channelization of rural intersections. Much can be done along this line to protect the driver and guide him along safe paths in his attempt to join, or cross, the traffic stream.

In all of these shortcomings and deficiencies on the state highway system, there are known practical methods of correction, but they all involve high expenditures. Our engineers and officials are constantly faced with this type of question: Should we spend $10,000 on a mile of pavement to make it more safe or should we use that money to replace muddy and dusty country roads with hard surface? We are always limited in what we can do.

No Assurance

Even if it were possible for us to remove all these deficiencies in the highway system, the accident records indicate that the rural fatal accident rate would be decreased by not more than from 2 to 8 per cent. And we cannot *assure* that this modernization would lower the accident rate to any substantial extent. There are so many other factors involved—such as liquor, enforcement, court action, vehicle condition and the like, that a definite appraisal is impossible.

We could find examples in the nation of the very safest highway designs which man can devise. Some of them would indicate accident records better than ours, and some could be found with accident records similar to ours. It is largely a matter of the driver, the vehicle, and the way in which the highways are used. We are sure that removal of highway deficiencies will help to lower the accident rate, but just how much it will help we do not know. We do know that the cost of overcoming these deficiencies is tremendous.

On the other hand, the prudent driver overcomes all these deficiencies simply through the practice of common sense, patience,

fair play, and common road courtesy. We believe that the worst hazards and deficiencies should be removed as promptly as possible, not only because they are hazards but because they often cause congestion and contribute to unreasonable delay.

But we also believe that real progress in accident reduction is primarily a matter of driver training, driver examination, and enforcement of safe driving laws combined with motor vehicle inspection.

Driver Examination Hereafter

The recent legislature took several important progressive steps in this direction. While these laws do not go into effect until July 1, I believe that the action of the legislature and its effect through the press on the public generally, is already being felt favorably in the accident record.

Each of North Carolina's estimated 1,100,000 drivers are to be examined at least once each four years hereafter. These examinations will be verbal in nature, and will cover safe driving rules, laws, and knowledge of signs. The examination will involve physical fitness such as vision, hearing, reaction, and the like and may involve the necessity of an actual road test in a large percentage of the cases. All persons who apply for the first time for a driver's license will be given the same test during the first year of the program and whenever they apply thereafter.

Beginning with January 1, 1948, the state law will require motor vehicle inspections, wherein every vehicle must be examined during 1948 and twice during each year thereafter. These examinations will include brakes, lights, steering gear, and other mechanical features related to safe operation.

The strength of the State Highway Patrol, which decreased to as low as 150 men (to cover 100 counties) during the war, and which now stands at a strength of 212, is immediately to be built up to a strength of about 413. Their duties and operations will be more restricted to work on highways, from the safety aspect, and they will no longer be subject to call by sheriffs and chiefs of police to aid in every type of criminal enforcement work.

Other Significant Developments

The discretionary powers of the courts have been severely restricted in cases involving excess speed, reckless or drunken driving; and, especially for repeat violators, the laws make mandatory certain increased fines and durations of sentence; and, in many cases, make mandatory the revocation or suspension of driver's license.

Another significant development has been the formation of the State-wide Safety Committee as a non-government organization, backed by business and industry, to operate along broad lines over a continuing five-year period to cut down the accident rate in the state. This activity is quite broad, and involves considerable personnel and expenditure.

I believe that our people are determined to cut the accident rate. If these steps are supported by the public and consistently prosecuted by our officers and judges, it is my belief that our state will soon improve its position in safety statistics. Every official and supervisory employee of the Commission is working toward that end. The State Highway Commission may be depended upon to do everything possible.

Safety in Surface Maintenance

ALBERT L. DONNELLY

Mr. Donnelly is Director of Roadway Maintenance in the Connecticut State Highway Department. He was in charge of roadway maintenance for the Connecticut Company at New Haven prior to entering the employ of the Connecticut State Highway Department in 1931. From 1931 to 1939, Mr. Donnelly was manager of the Connecticut State Highway Department. In 1939 he was advanced to his present post of Director of Roadway Maintenance in charge of all maintenance on Connecticut State highways.

MANY ITEMS claim consideration when we discuss the safety aspects of street and highway surfaces. These include:

Precautions for assuring non-skid surfaces; relief from unexpected isolated icy conditions on highways; 'correction of poor drainage; correction, where practical, of conditions causing serious frost breaks; proper super-elevation of curves for travel at predetermined speeds on each section of highway; elimination of extremely hazardous sight-line restrictions, and the modernization of high-crown cross sections on old roads.

In the surface treatment of gravel, waterbound macadam, old bituminous macadam and concrete pavements under certain conditions, the use of a coarse cover creates a skid-resistant surface. Under wet pavement conditions a coarse surface may effectively reduce the tendency towards skidding and make for a safer roadway for abrupt stops.

The degree of coarseness desirable depends upon characteristics of traffic, the availability and cost of materials, and on other local conditions. Depending upon conditions, one-quarter-inch, one-half-inch or five-eighths-inch stone is used for aggregate. In so-called "stone surfacing," asphalt cement and asphalt cut-backs are used for bitumen.

When sand is the cover, coarse sand helps make traffic operations safer in that it usually develops a long-life non-skid surface. In fact, some tests of skidding characteristics of pavements have shown that

the high-type, coarse-sand finishes develop the highest frictional coefficients.

Surfaces in which good traction is inherent in the pavement-type itself, or surfaces in which traction is afforded by the addition of stone, are extremely helpful on bridges and steep hills. This is particularly true when the pavement is wet. It is specially helpful also under frost conditions, and in the early period of ice storms and wet snowstorms.

Winter Surface Problems

In the winter, the cold air mass under bridge decks frequently creates white frost on the pavement surface, though the pavement will be dry on each side. This makes an unexpected hazard for the motorist. A similar condition exists in sun-sheltered areas in rock or steep earth cuts, and in locations where there are pine groves close to the road. Also unexpectedly hazardous are locations where snow-water or seepage in cuts runs across the surface of the pavement.

At such places during the winter when the temperature is above the freezing point during the daytime and a sudden drop in temperature sets up ice across the road, maintenance crews should sand the spots while they are wet. That is, before the crews quit work in the afternoon. Otherwise, extremely hazardous conditions may develop before maintenance begins the next day.

Permanent correction of these conditions can be made by installing drainage structures—either surface drainage or sub-surface drainage—or by reshaping the shoulders to keep surface drainage on the high side of the road. The old practice of continuing the banking of curves through the high-side shoulders leads to these potentially dangerous conditions.

The high side shoulders on super-elevated curves should be rounded and sloped down to keep water from running across the pavement. Additional width outside of shoulder areas in cuts for depositing snow designed to keep drainage snow water below the pavement level is extremely desirable to prevent water from running onto the pavement.

In new construction, advice by maintenance men to construction

engineers of the desirability of embodying designs of proved safety measures for winter conditions is necessary.

This suggests also that maintenance departments should be alert to detect deficiencies in road design that create traffic hazards or unduly increase maintenance operations. A constant interchange of information between maintenance and design departments can add greatly to the improvement of design.

Accident Records Point the Way

Accident records with the data on locations of accident frequency broken down by road hazards and contributory physical conditions, have been very helpful in selecting preferential points for correction and in establishing programs and priorities for such work.

Such physical conditions might be: (1) lack of sufficient superelevation on curves; (2) high crowns causing a side-slipping of cars when the road is icy or resulting in a tendency of drivers to hog the center of the road; (3) slippery conditions on steep grades; (4) bank encroachments; (5) high hedges, fences or walls, and other physical conditions causing restricted sight distances; (6) slippery bridge surfaces; (7) seepage across the pavement surface of water from cuts or melting snow; and (8) frost heaves.

Speeds Consistent, or Zoned

Speed checks to determine safe speeds along highways, and to establish reasonable and enforceable speed limits can do much to decrease accidents. A proper posting of limits will inform the public of physical road limitations in horizontal and vertical curves, in surface conditions and other ways that require speed reduction.

In determining the safe normal speed on given sections of highways, horizontal and vertical curves are usually found to be the restricted points. Ball bank indicators can be used on the dash of test cars to determine the safe speed on horizontal curves. These Ball bank indicators consist of a glass, liquid-filled, curved tube with a ball inside free to move in the liquid. The tube is graduated on each

side from 0° to 20°. The ball is set at 0° on level stretches approaching curves. As the car moves around the curve the centrifugal force together with the car roll forces the ball up into the tube.

When using Ball bank indicators, care should be taken to select test vehicles that are representative. If several vehicles are used, tests over typical curves should be made with each vehicle to determine whether there are significant differences. Test drivers also should be selected carefully and trained in uniform operation. The uniform speed of the car at which the ball reading in the tube does not exceed 10° is considered a safe speed for the average car. But, to obtain drivers' respect for speed limits over a wide range of speed, the following ball-bank angles may be used: 14° for speeds below 20 m.p.h., 12° for speeds of 25 and 30 m.p.h., and 10° for speeds of 35 m.p.h. and higher.

The safe or critical speed for a curve may be calculated by use of the standard formula for the relation between speed, super-elevation and lateral friction. The formula is:

$$V = \sqrt{\frac{(e + f)\ R}{0.067}}$$

in which

f = friction factor

V = speed in m.p.h.

R = radius of the curve in feet

and

e = super-elevation in feet per foot

The coefficient of friction (f) bears a direct relationship to the surface type. For calculating safe speeds, values ranging from 0.2 for low speeds to 0.15 for high speeds, are normally used.

Prevailing speeds may also be used to discover the speed that drivers consider a reasonable maximum for curves. The speeds of at least 200 vehicles in each direction are observed while rounding the curve and the speed value at or below which 85 or 90 per cent of

the vehicles travel is used as a guide in determining the critical speed.

When the *safe* speed on such curves is less than the *reasonable* speed for the section of highway adjoining, an increased super-elevation is desirable. It can be obtained by the use of bituminous concrete if the fill is not excessive. Where it *is* excessive, a wedge-course of gravel can be used. This gravel should be surface-treated. Or, if traffic conditions require it, the necessary super-elevation may be obtained by building up with a wedge-course of gravel, kept low enough to allow a top wearing surface of bituminous concrete.

Sub-Surface Drainage Essential

Sub-surface drainage installations have done much to prevent pavement heaving and frost boils; also icy surface conditions on the shoulders and traveled way. These installations, established at a depth below frost lines predetermined after digging test holes, cuts water off at the side of the road and helps to keep this water from getting under the road. Six-inch and eight-inch bituminous coated perforated spiral pipe has been found satisfactory for collecting of underground water. The pipe is set at depth of four feet in a trench backfilled with one-quarter-inch to one-half-inch aggregate.

Pipe outlets should be marked for observation by maintenance men. Where it is desired to take care of both surface and sub-surface water in one line, twelve-inch and fifteen-inch perforated pipe or reinforced concrete pipe with open joints have worked out well. For heaving at spotty locations where there is a high capillary soil, the best corrective measure is in the removal of poor sub-base material and replacement with a good grade of gravel.

High Crowns Develop Hazards

High crowned pavements on heavy traffic roads tend to create the possibility of accidents due to cars using the middle of the road. And when the pavement is wet or icy, high crowns sometimes cause vehicles to side-slip. Correction of such high-crowned roads can be made by the same methods as previously outlined for increasing the super-elevation of curves.

Maintenance Men Have Many Safety Opportunities

Roadway maintenance men can make major contributions to the safety records of states and cities. In general, road maintenance is not colorful. It consists in making all necessary repairs, replacements and betterments to continue and improve the utility value of the transportation facilities. Maintenance men are naturally safety conscious. It is to them that the motoring public looks for safe operating roadway surfaces in all seasons of the year .

Uniformity in Traffic Markings

HARRY E. NEAL

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BECAUSE we use the motor vehicle so much for travel in different states, it is important that there be *national uniformity* in traffic rules and regulations, and in such visual aids to driving as signs, signals and markings. It is important that the driver be neither endangered nor confused by unfamiliar or inadequate directions.

Each state and community owes a duty to the visiting driver as well as to its own drivers, to see that proper facilities are provided to guide him, and to advise him of local regulatory measures. Many regulatory measures are not enforceable in the absence of proper notice. From the standpoint of justice and efficiency, a notice is not proper unless it is understandable.

The highway, the vehicle, and the driver are the three basic elements in highway transportation. The driver is most important so far as safety is concerned. He must operate in accordance with conditions, and he must be given all possible aid in the way of signs, signals, and markings to enable him to properly fit his driving to conditions. Even where highways, weather or other conditions are unfavorable, the driver *can* generally make the necessary adjustment

by driving more slowly and carefully. But the driver can not justly be held at fault when a hazard is not efficiently marked.

Should Avoid, Not Create, Confusion

In designing and applying visual aids, officials should consider the mental and physical characteristics of the driver, particularly his vision, both day and night. They should consider also his perception plus reaction time under varying conditions. Signs should be designed and located so that the driver can see them far enough ahead to grasp their message *in time* to make the proper reaction to them. In situations requiring split-second decisions there is no time for study and reflection.

A contributing cause in many traffic accidents is confusion because of surprise or a lack of clear and concise advance warning as to the action required. Such a situation may arise from a potential hazard in the roadway itself, such as a sharp turn, a narrow bridge, an intersection, or other physical conditions. It may also be created by inadequate advance information as to the route. Anything that contributes to confusion may contribute to an accident.

Confusion may be caused not only by the absence of proper and timely warning or information, but also by a distracting multiplicity of signs, signals, or markings. Confusion may result also from signs or signals that lack sufficient visibility because they are improperly located. Signs, signals, or markings that do not conform to *patterns* with which the driver is familiar are frequent causes of confusion, misinterpretation or hesitancy. Such accident factors point to a need for uniformity.

As Well Understood as English

All accidents are not, of course, caused by the driver's surprise or confusion. But if we eliminate surprise or confusion, we shall contribute much to the reduction of the mental strain and fatigue in driving which frequently contribute to accidents.

The ideal highway would be one in which safety is built into the highway, with sight distances fitted to the prevailing speeds,

physical separation of traffic moving in opposite directions, no grade crossings, controlled access—that is, highways in which all elements of surprise or confusion are eliminated. For many years to come, however, we shall still have thousands of miles of highways that need visual aids.

Visual aids in the form of signs, signals, and pavement markings are still, therefore, necessary tools for traffic control. But to be of greatest value they should be as universally understood as the English language in this country. A driver should not be expected to reason out the meaning of a traffic control sign, signal, or marking.

The designs should be such that the most illiterate driver can understand their meanings. To accomplish this, traffic control devices must not only be visible, legible, and clear under all conditions, but there must be *consistency* in their use.

The misapplication or excessive use of signs, signals and markings, especially those of the warning or regulatory type, tends to create disrespect for them. The use and application of warning or regulatory traffic control devices should, therefore, be based on a factual study of their need and not on guess work or opinion.

On the other hand the frequent, *well-placed,* display of route markers and directional signs will not lessen their value. In fact, added assurance is given by the duplication of route markers or directional signs at critical points.

Proper Location

If a sign indicating an actual or potential hazard, or directional information at a critical point, is not of sufficient importance to require that it be as visible and legible at night as in daylight, it ordinarily has no place on the highway. Such signs are more important at night than in the daytime. All signs that mark potential hazards, signs indicating important traffic control regulations, such as STOP signs, signs indicating special speed limits, and signs giving essential directional information, should be reflectorized or otherwise illuminated. Signs having daylight application only, such as School, Parking regulations, historical and scenic markers, need not be reflectorized or illuminated.

The proper location of a sign is important. Signs warning of hazards, or signs giving necessary information, such as directional signs and markers, should be placed sufficiently in advance of the point to which they apply to allow the driver time to complete the maneuver required of him. The distance a sign should be placed in advance of the point it marks depends on the prevailing speed on the approach to that point. The distance must be sufficient to allow time for slowing to a speed safe for the required action on the part of the driver.

Where the speed of approach is relatively high, a greater distance for slowing up is of course required, and the sign should accordingly be put a greater distance ahead. If advance indication is given at a sufficient distance from the point to which it applies, the driver is given time to complete the required maneuver comfortably and safely.

Traffic control devices should also be so located that the view of them is not obstructed by curves, dips in the road, foliage, or other obstructions to sight distance.

Placed Where Study Indicates

Consistency or uniformity in the application of signs and other traffic control devices is especially important. Identical conditions should always be marked with the same types of signs regardless of where those conditions occur. Each sign should be used for one definite and specific purpose only. Stop signs, for example, should be used only where a study of physical and traffic conditions shows them to be necessary. Warning or slow-type signs should be used only where a study of conditions indicates an actual need for them.

As a general rule, signs should be placed on the right hand side of the road. However, standardization of position cannot always be attained in practice because signs in all cases must be placed in the most advantageous positions and must be accommodated to highway design and alignment. Signs may sometimes be placed to advantage on channelizing islands, or overhead, or, as on sharp curves to the right, on the left hand shoulder of the road directly in front of approaching vehicles. In such cases the signs should be definitely

more conspicuous than signs normally placed. Supplementary signs on the left of the roadway may often be advantageous on three-lane or four-lane roadways, or on a one-way road, where traffic in the right hand lane interferes with the driver's view to the right.

Signs at intersections giving directions and distances to places ahead, or to the right or left on intersecting roads, should be in advance of the intersections in order to give the driver the necessary information before reaching the intersection. Signs indicating points ahead which are placed parallel to the direction of travel are difficult to read except when the motorist has stopped or is moving slowly. Such signs placed well in advance of an intersection and at right angles to the direction of travel give the driver time to read them even at a fairly high speed and to get into the proper lane to execute a turn to the right or to the left.

Uniformity of Design

From the standpoint of design, all traffic signs applicable to the same type of condition or conveying the same kind of information should be uniform with respect to shape, color, and message. They should also have reasonable consistency as to size and illumination. Modern highway speeds and increasingly complex intersections require that traffic control signs be recognized and understood at a glance. Uniformity and simplicity of design are of the greatest importance in aiding recognition.

It is important that signs be of adequate size to fit conditions. Oversized signs with letters or symbols in proportion are sometimes needed to emphasize the warning or message or to meet the demand for greater legibility on highways where relatively high speeds prevail. Oversized directional signs are needed at complicated intersections to prevent confusion. There are locations were signs considerably larger than the standard, even of "billboard" proportions, may be advisable to compel attention and insure proper driver reaction.

National standards for traffic signs and other traffic control devices have been developed by joint action of the American Association of State Highway Officials, the Institute of Traffic Engineers,

and the National Conference on Street and Highway Safety through the Joint Committee on Uniform Traffic Control Devices. This committee, which is a continuing committee, consists of seven members from each organization who are experienced in the field of traffic control.

A Manual on Control Devices

The present Joint Committee was appointed in 1942 to bring up to date the work of standardizing traffic control devices which was begun in 1925 by a Joint Committee of the U. S. Bureau of Public Roads, now the Public Roads Administration, and the American Association of State Highway Officials. The first Manual of Uniform Traffic Control Devices was published by this Committee in 1927 and was revised in 1929. A new Manual was issued in 1935 and revised in 1939.

The present Joint Committee has just completed the preparation of a new Manual on Uniform Traffic Control Devices which will soon be published.

In the new Manual, four basic shapes for traffic signs are prescribed:

1. The octagon shape for STOP signs only.
2. The diamond shape for signs warning of potential hazards inherent in the roadway such as curves, narrow bridges.
3. The circular shape for railroad grade crossings only.
4. The rectangular shape for informational and regulatory signs.

All of the octagon, diamond and round signs have black legends or symbols on a yellow background. All rectangular signs, with the exception of the parking regulation signs, are black on white, or in the cases of oversize information, or directional signs, white on black is permissible. Parking regulation signs are red on white where parking is prohibited, and green on white where parking is permitted for a limited time or in a specified manner.

In the new Manual, all signs with word messages have rounded letters instead of the old type block or rectangular letters formerly used. This change was made after a study showed clearly that the

use of rounded letters materially improved the legibility. It was found also that rounded letters are much better adapted to reflectorization by reflector buttons.

The sizes of some of the standard signs were increased for better legibility. For example, the size of the STOP sign was increased from twenty-four inches to thirty inches with a minimum height of the letters in the word STOP of ten inches instead of the former six-inch letters. Some of the other signs with word messages were also increased to thirty inches to permit of better design for legibility.

Another change was the elimination of the R and L Turn Markers and the substitution of Turn Arrow symbols. Also the Winding Road sign was changed from a word message to a symbol sign.

A traffic control signal, that is, a STOP and GO signal, is a valuable device for the control and safety of vehicle and pedestrian movement. Traffic control signals should also be uniform in design. The Manual on Uniform Traffic Control Devices specifies three lenses to each face with the red lens at the top or the left and the green lens at the bottom or the right depending upon whether the signal is mounted in a vertical or horizontal position.

In all cases, a traffic control signal installation exerts a profound influence on traffic flow and will operate quite definitely to the advantage or disadvantage of the vehicles and pedestrians controlled by it. Consequently, it is important that traffic control signals be installed only after a thorough study of roadway and traffic conditions.

There is a widespread belief among laymen that a traffic control signal is a cure-all for every type of traffic difficulty at an intersection. This has led to the installation of such signals at many intersections where no legitimate or economic justification exists for their use. Traffic control signals should be installed only where traffic conditions justify their use.

The new Manual prescribes specific needs that define the conditions under which such signal installations may be warranted. These warrants are based on considerations of traffic volumes, pedestrian volumes, accident history, the need to interrupt a continuous flow to let cross traffic move, and other factors.

Conditions That Justify Devices

Since urban and rural areas have basic differences with respect to traffic control, separate values are given for the warrants for rural and for urban installations. For example, the minimum warrants for the installation of traffic control signals on two-lane, two-way, streets or highways are as follows:

Vehicular Volume

(a) The total vehicular volume entering the intersection from all approaches must average at least 750 vehicles per hour in urban areas, and 500 vehicles per hour in rural areas for any 8 hours of an average day; and

(b) The total vehicular volume entering the intersection from the minor street or streets must average 175 vehicles per hour in urban areas and 125 vehicles per hour in rural areas for the same 8 hours.

Vehicles on through streets or highways tend, if uncontrolled, to travel through intersections with other streets or highways at speeds that make it difficult or dangerous for vehicles to cross or enter the main traffic stream.

The following warrants have been established to determine the conditions under which a traffic control signal is justified because of the necessity for interruption of continuous flow:

(a) The vehicle volume along the main street or highway must average at least 750 vehicles an hour in urban areas, or 500 vehicles per hour in rural areas for any 8 hours of an average day; and

(b) The combined vehicle and pedestrian volume from the minor street or road must average at least 75 units per hour in urban areas, or 50 units per hour in rural areas, for the same 8 hours; and

(c) The average vehicle speed exceeds 20 miles per hour on the principal artery in urban areas, or 35 miles per hour in rural areas.

The criteria established for the installation of traffic control signals on the basis of pedestrian protection are:

(a) The pedestrian volume crossing the artery must average at least 250 persons per hour in urban areas, or 125 persons per hour in rural areas, for any 8 hours of an average day; and

(b) Vehicular traffic entering the intersection from the artery must average at least 600 vehicles per hour in urban areas, or 300 vehicles per hour in rural areas, for the same 8 hours; and

(c) The average vehicle speed on the approaches to the intersection must exceed 15 miles per hour in urban areas, or 30 miles per hour in rural areas.

Sometimes, the installation of a traffic control signal may be justified on the basis of accident hazard alone. But, if none of the needs except the accident hazard exists, the initial assumption should be against the signal.

Accident Data Criteria

The following accident hazard criteria for justification of a traffic signal have been established:

(a) When adequate trial of less restrictive remedies with adequate enforcement has failed to reduce accidents; and

(b) When five or more reported accidents of types susceptible of correction by a traffic control signal have occurred within a 12-month period, each accident involving personal injury or property damage to an apparent extent of $25 or more; and

(c) There exists a volume of vehicular and pedestrian traffic not less than 50 per cent of the requirements specified in the minimum vehicular volume warrant, or the minimum pedestrian volume warrant.

Fixed-time traffic control signals may sometimes be justified where no one warrant is satisfied but two or more are satisfied to 80 per cent or more of the stated values.

Because traffic-actuated signals do not normally delay traffic except when it needs to be delayed to avoid contact with traffic on cross streets or roads, it was not considered practical to set values of minimum vehicle volumes or other fixed warrants for their use.

Pavement Markings

Pavement markings also have an important place in traffic control. They promote orderly movement by helping to keep traffic in its proper lanes. They are particularly valuable for indicating zones of limited sight distance where overtaking and passing is unsafe. They also are important safety factors at night and in fog.

The commonest method of applying pavement markings is by paint. The use of paint that becomes luminous under headlights by

minute glass spheres embedded in the paint has made such markings much more visible at night.

As in the case of other traffic control devices, uniformity in the design and use of pavement markings is important.

The Greatest Lack

Probably the greatest lack of uniformity in traffic control devices has existed in the design of pavement markings. There have been several different systems of marking no-passing zones used in the various states. The system used in several of the Mid-Western states to indicate no-passing zones consists of a solid yellow auxiliary or barrier line alongside a solid or dashed white center line. In several of the Eastern states a no-passing zone is indicated by a solid white barrier line along a dashed white center line.

There has been considerable controversy over which system is the most effective which probably will not be settled until an actual study of the relative effectiveness of the two systems has been made. However, the new Manual on Uniform Traffic Control Devices provides that a dashed or broken line with 15-foot segments and 25-foot gaps should be used for center lines and lane lines where such lines are only guide lines which may be crossed at the discretion of the driver. It is provided that no-passing zones shall be indicated by a solid barrier line parallel to the center line on the side from which passing is prohibited. It is recommended that the barrier line be yellow although white is permissible.

The standards for traffic control devices prescribed by the new Manual on Uniform Traffic Control Devices represent the composite experience and considered judgment of the members of the Joint Committee. The standards it establishes constitute the latest and best in traffic control devices and their use. The standards established by the Manual should be followed as closely as possible by all political subdivisions in the interest of national uniformity.

The appalling traffic accident toll highlights the need for uniformity in the design and application of traffic control devices. A uniform, well placed, and well maintained system of traffic control

devices is an important aid to the safety and facilitation of traffic movement.

In order that drivers may benefit from necessary uniformity and consistency in traffic control devices, this work should be supervised by those trained and experienced in the field of traffic control. Improvements made in standards should be accompanied by increased skills in their use.

Eno Foundation Publications

The following publications are available to traffic officials and others interested in traffic problems. Single copies will be distributed free of charge until supplies are exhausted. Address all requests to:

THE ENO FOUNDATION
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PARKING; December 1946

A review of the parking problem as it exists today in American cities. Discussions on the characteristics of the problem; demands imposed by motorists for curb parking; and various methods used to control curb parking. Different types of off-street parking facilities are discussed; as well as the experiences of many cities in the regulation and operation of off-street facilities. One chapter is devoted to the problem of parking along rural highways. The report is well illustrated and contains a selected bibliography of pertinent references.

ZONING APPLIED TO PARKING; March 1947

A review of current practices in zoning ordinances requiring the provision of off-street parking and loading facilities in connection with new buildings. The distribution of zoning ordinances among cities of the various population groups is discussed; and the requirements for various types of buildings are listed.

The experiences of cities in allowing parking space to be provided at various distances from the building are discussed; and sections from several ordinances are quoted.

THE ORGANIZATION OF OFFICIAL TRAFFIC AGENCIES IN CITIES AND STATES; November 1946

A study of traffic organizations in Police Departments and Engineering Divisions of cities and states. The functions for which traffic agencies are responsible are discussed; salary ranges for heads of traffic agencies are tabulated and compared with salaries of other bureau heads in Police and Engineering organizations. The titles given to traffic agencies are listed, as well as such other pertinent data as: Method of appointment of traffic directors; traffic training; qualifying examinations for traffic heads; and the effects of the recent war on traffic engineering organizations.

TRAFFIC SAFETY EDUCATION – A GUIDEBOOK FOR STATE AND CIVIC OFFICIALS

A guidebook outlining the steps that should be undertaken by a city in establishing a traffic safety program. Safety education in elementary and high schools is treated; driver education for high school students is outlined; and suggested programs for the in-service training of teachers in safety education are included. The various methods of keeping the public informed on matters of traffic safety are reviewed; and a selected list of visual aids for use in a traffic safety education program are listed.

AN ECONOMIC STUDY OF INTERIOR BLOCK PARKING FACILITIES; 1946

A report published jointly with the Bureau of Highway Traffic, Yale University. Results of a study made in New Haven, Connecticut are reported: Values for various parcels of land in the central district are compared; land values along streets in the central district are related to vehicle volumes and pedestrian volumes along the streets. The study proves that the use of land within the interior of city blocks permits the provision of off-street parking facilities with a minimum of expenditure and minimum interference with tax-paying properties along the streets.

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